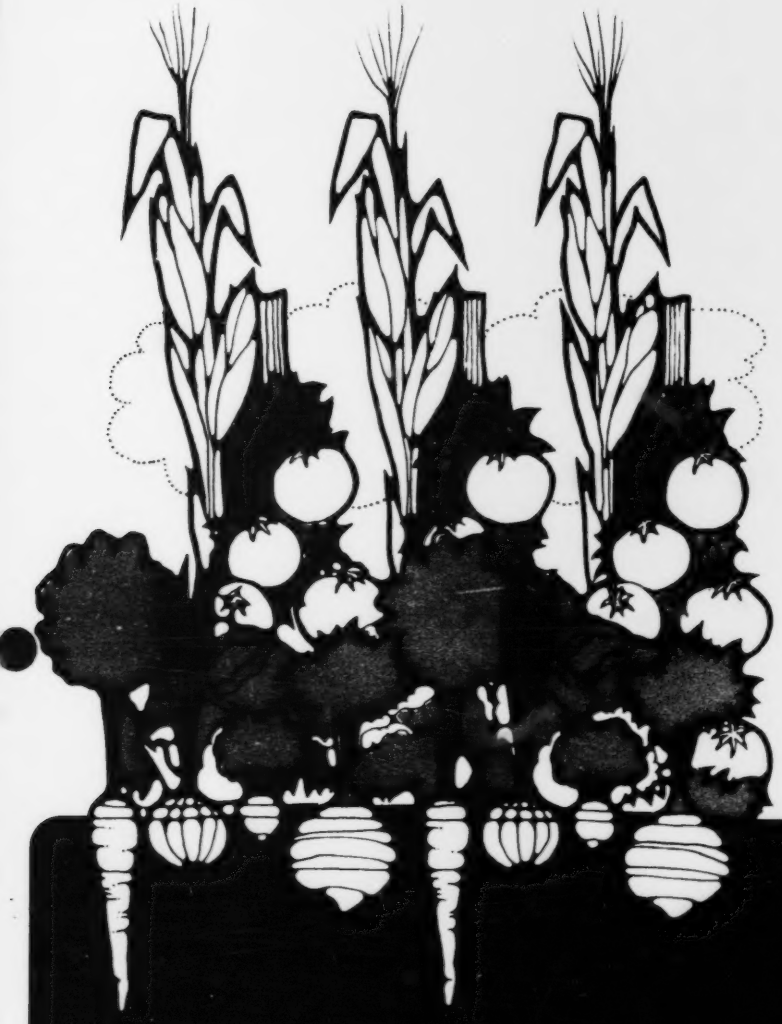
Agdex 260-32.



1983 Vegetable Crop Production Guide

1983 Vegetable Crop Production Guide

The 1983 Vegetable Crop Production Guide provides the most up to date information on varieties, cultural techniques, harvest and storage and pest control measures for Manitoba production.

The information within is based on research and field experience. Additional information may be obtained from your agricultural representative, vegetable crop specialist, or researchers of the Plant Science Department, University of Manitoba and Agriculture Canada, Morden, Manitoba.

This publication is prepared annually by Manitoba Agriculture in cooperation with the Plant Science Department, University of Manitoba.

In this publication most recommendations list several pesticides that are effective for each insect, disease or weed discussed. It must be emphasized that in some cases the most effective pesticides are highly toxic. A list of all pesticides and their mammalian toxicity recommended in this guide is found on Pages 5 to 6 and pages 6 to 8, respectively.

The effectiveness of pesticides, and plant injury by control chemicals, are influenced by the weather and other conditions. Consult the package label and other information regarding compatibility with other materials, the effect of high or low temperatures, poor drying conditions, etc. Wettable or soluble powder (WP, AP, SP or W) preparations generally are less likely to cause plant injury than liquid concentrate (EC, SC and F) formulations.

A number of brand or trade names of chemicals are used for the convenience of readers. This constitutes neither an endorsement of the product nor a suggestion that similar products are not effective.

The amounts of materials stated in the recommendations are for each hectare actually covered, unless otherwise stated. The amount of water used per hectare in ground spray equipment may vary depending on the pest to be controlled and type of equipment.

Recommendations are for the 1983 season and may be revised whenever further information is available. Discard old editions. The pesticide recommendations are for COMMERCIAL plantings. Home gardeners should consult Manitoba Agriculture for use of recommended pesticides.

For advice related to pests, spray mixtures, spraying and timing of applications, consult your Agriculture Representative or Provincial Vegetable Crop Specialist at 857-9711, ext. 275.

For additional production information refer to the publications listed on page 42.

Pesticide Resistance

Many of the pesticides recommended have a very specific mechanism of action; that is, they act on a single system or site in the organism. These materials SHOULD NOT BE USED CONTINUOUSLY AND REPEATEDLY in a season-long program since this will increase the chances of the development of pest resistance. Examples of these types of compounds are Benlate, Lannate, the pyrethroids (Ambush, Belmark) etc.

In our recommendations we suggest that such compounds be used IN COMBINATION WITH OTHER PESTICIDES OR THAT THEY ARE ALTERNATED WITH OTHER PESTICIDES so that the likelihood of resistance development is reduced.

It should be noted that several pesticides may act similarly. Thus, parathion and Guthion, for example, act on the same site, and if resistance develops to one, it is likely to apply also to the other. (This is called cross resistance.) Thus, alternating these compounds will not be useful. Rather, they should be alternated with insecticides with different modes of action; for example Thiodan or methoxychlor.

All pesticide products are registered by Agriculture Canada. No pesticide, or tank mixes of pesticides, may be used on any crop for which it is not registered. Such use can result in seizure of crop.

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Precautions with Pesticides

Rules Everyone Must Know Before Using Any Pesticides

1. Always read the label before opening pesticide containers. Follow all precautions and directions precisely.
2. Never smoke, chew tobacco, or eat while handling or applying pesticides. Do not carry these items in clothes used for spraying.
3. Avoid spilling pesticides on skin or clothing. If an accident occurs, remove contaminated clothing immediately, and wash contaminated skin thoroughly with soap and water. Wash clothing before wearing.
4. Wash thoroughly with soap and water after applying or handling pesticides.
5. If clothing becomes wet with a pesticide, remove it immediately. Always wash clothing after each spray operation.
6. Avoid inhaling spray droplets, dust or fumes.
7. Clean-up pesticide spills immediately. Use dry soil or other absorbent material to remove excess liquid. If a spill is major, call: Environmental Management Branch, Building 2, 139 Tuxedo Ave., Winnipeg, Manitoba R3N 0H6. Phone: 944-4888 (24 hours).
8. If symptoms of illness occur during or shortly after handling or applying pesticides, get to a hospital immediately. If possible, take a labeled container of the pesticide with you. (See Emergency Procedures for Pesticide Poisoning, Page 4).
9. Avoid contamination of water supplies, wells, ponds, streams, etc., with pesticides when filling or flushing out spray equipment. Never fill a sprayer directly from a stream or pond, unless the unit is equipped with an anti-siphoning device to prevent backflow. Use an injection or siphon filler to fill an overhead tank and fill the sprayer from it.

Storage

1. Keep pesticides out of the reach of children, inexperienced persons, pets and livestock. Store them in a locked room away from the home. Post pesticide-storage-area notices.
2. Always store pesticides in orginal containers and keep them tightly closed. Never put pesticides in unmarked containers.

Disposal of Pesticide Containers and Contaminated Material

1. Containers from pesticide packages and any paper or other material used to clean-up spills should be buried or burned. Make sure that people and animals are kept away from the smoke and that the smoke is not directed toward buildings, highways, roads, or public outdoor areas.
2. Rinse all empty metal or glass containers three times with water, add washings to the spray tank. Dispose of the containers by puncturing or breaking or burying the container in such a manner that it is covered by at least 50 cm of soil and is not near any watercourse or water table.

Pesticide Drift

Pesticide drift can leave unwanted residues on adjacent crops, be a hazard to people and livestock nearby, and reduce the amount of material in the target area so that it is ineffective.

Those applying pesticides should make every effort to minimize or prevent pesticide spray drift by:

1. correct calibration and maintenance of spray equipment
2. correct operation of the equipment
3. being aware of the toxicity of the pesticide being used
4. being aware of the weather conditions.

Custom Application — Ground and Air

Custom applicators must be licensed by Manitoba Agriculture.

It is an offense under the Federal Pest-Control Products Act to use a control product under unsafe conditions. Precautionary practices must be heeded at all times to prevent drift. Extra precautions should be taken when using insecticides applied by air, especially those known to be toxic by honeybees, e.g. Sevin (carbaryl).

Applications should not be made if the wind is blowing. Even on the stillest day, some drift occurs; to keep it to a minimum apply pesticides in the evening or early morning.

Be sure that the contract specifies the product to be used and its rate of application.

Protective Clothing When Using Pesticides Outdoors

1. When measuring and mixing pesticides, wear neoprene or rubber gloves, rubber boots, a protective apron or coveralls, and protective eye shields. (Inexpensive disposable aprons, shirts, pants, and headwear are also now available.)
2. Wash all protective clothing after use.
3. Wear a chemical cartridge respirator with dual chemical cartridge when mixing or applying pesticide. The following respirators are recommended for outside use against light pesticide concentrations:

   WILLSON AGRI-TOX 2 Respirator with R21 cartridges and R15 filters

   NORTON 7549 or 7649 Respirator with 7500-21 cartridges and 7500-23 filters

   MSA 448848 or 460560 Respirator with 464025 combination cartridges

AMERICAN OPTICAL R4058, R5053 or R6058 Respirator with R50 filter/cartridges

PULMOSAN 241 Respirator with 241-7 filter/cartridges

SAFETY HOUSE OF CANADA 236-G100-F104 Respirator with G100 cartridges and F104 filters

H.S. COVER 1482 Respirator with 100 cartridges and 104 filters.

They should always be worn when applying pesticides listed in the 'highly toxic' categories in this publication. Change cartridges according to manufacturer's directions.

A powered chemical cartridge respirator, W-262 GENERAL-PURPOSE SYSTEM, is now available from the 3M Company, and is suitable for vehicle mounting.

Disposable Plastic and Waterproof Clothing

There are now available plastic aprons, disposable hoods, laboratory coats, boot covers, coveralls, protective female smocks, and hat covers at a reasonable price. A special two-piece coverall set for easy movement and comfort is also available.

Any of the above are available direct from TITAN Disposables Limited, 8530 Esplanade Ave., Montreal, P.Q. H2P 2R8. Telephone (514) 381-2301. Telephone or write for prices and further information.

Protective clothing is also available from many of the safety-supply companies.

Emergency Procedure For Pesticide Poisoning

If a person suspects poisoning from exposure to a pesticide by swallowing, inhalation, or contact with skin or eyes, read the label on the pesticide container and carry out the first-aid treatment suggested.

If a pesticide has come in contact with the skin or has been spilled on clothing, remove the clothing and wash the skin thoroughly with soap and warm water.

If a pesticide has come in contact with the eyes, rinse them with plenty of water for 15 minutes.

IMMEDIATELY AFTER THE FIRST-AID TREATMENT HAS BEEN GIVEN, WRAP THE PATIENT IN A COAT OR BLANKET AND RUSH HIM TO THE NEAREST HOSPITAL. TAKING THE LABELED PESTICIDE CONTAINER WITH YOU.

First-Aid Information

Poison Control
Health Sciences Centre
Children's Centre
685 Bannatyne Avenue
Winnipeg, Manitoba
R3E 0W1

Telephone 1-787-2591

Reentry to Treated Areas

Pesticide poisoning may occur where workers enter fields too soon after pesticides have been applied. Such poisoning can result from handling treated plants or from inhalation of pesticide fumes.

The following pesticides are those for which a specific minimum interval must be observed from the time of application to the time of working in the crop. For some pesticides, e.g. parathion, the label carries a warning regarding working in treated crops. **Follow these recommendations.** Where no label warnings are provided, the following minimum intervals are recommended.

24 hours
Lannate
Supracide

48 hours
Birlane
Dasanit
Furadan
Guthion
Meta-Systox R
Monitor
Phosvel
Systox
Temik

Pesticides for Protecting Vegetable Crops

Only compounds recommended in this guide are listed. No endorsement of named products is intended, nor is criticism implied of similar products not included.

Pesticides listed are recommended on the basis of safety, effectiveness, availability and cost. Those not listed may be used in Manitoba if they are registered under the Canada Pest Control Products Act.

Rates of application for insecticides, herbicides and fungicides are stated as actual amounts of product required per hectare (acre).

Fungicides

anilazine ..... Dyrene
Arasan ..... thiram, Thiram
Basi-cop ..... fixed copper, Tri-cop, Neutro-cop, Kocide 101
Benlate ..... benomyl, Tersan 1991
Benomyl ..... Benlate, Tersan 1991
benomyl ..... Benlate, Tersan 1991
Bravo ..... chlorothalonil
captafol ..... Difolatan
Captan ..... captan, Orthocide
captan ..... Orthocide
carbothiin ..... Pro-Gro
chlorothalonil ..... Bravo
copper sulphate (bluestone) ..... copper sulphate (bluestone)
Difolatan ..... captafol
Dithane M-22 ..... maneb, Manzate D
Dithane M-45 ..... mancozeb, Manzate 200
Dithane Z-78 ..... zineb
Dyrene ..... anilazine
Easout ..... thiophanate-methyl
fixed copper ..... Basi-cop, Tri-cop, Neutro-cop, Kocide 101
Kocide 101 ..... fixed copper, Basi-cop, Tri-cop, Neutro-cop
mancozeb ..... Dithane M-45, Manzate 200
maneb ..... Dithane M-22, Manzate D
Manzate D ..... maneb, Dithane M-22
Manzate 200 ..... mancozeb, Dithane M-45
Mertect ..... thiobendazole
metiram ..... Polyram
Neutro-cop ..... fixed copper, Basi-cop, Tri-cop, Kocide 101
Orthocide ..... Captan
Polyram ..... metiram
Pro-Gro ..... carbathiin-thiram
Tersan 1991 ..... benomyl, Benlate
thiobendazole ..... Mertect
thiophanate-methyl ..... Easout
Thiram ..... thiram, Arasan
thiram ..... Arasan
Tri-cop ..... fixed copper, Basi-cop, Tri-cop, Neutro-cop, Kocide
zineb ..... Dithane Z-78

Herbicides

Aatrex ..... atrazine, Atrazine
Afolan ..... linuron, Lorox L
Agricultural Weed Killer No. 1 ..... stoddard solvent
Alanap ..... naptalam
Alachlor ..... Lasso
Amino triazole ..... Amitrol T, Cytrol
Amitrol T ..... amino triazole, Cytrol
Atrazine ..... atrazine, Aatrex
atrazine ..... Aatrex, Atrazine
Banvel 3 ..... dicamba + 2, 4-D + mecoprop, Kil-mor
Basfapon ..... dalapon, Dowpon
Basagran ..... bentazon
bensulide ..... Prefar
bentazon ..... Basagran
bromoxynil octanoate ..... Torch, Pardner
butylate ..... Sutan
cycloate ..... Ro-Neet
Cytrol ..... amino triazole, Amitrol T
dalapon ..... Basfapon, Dowpon
2, 4-D Amine ..... 2, 4-dichlorophenoxyacetic acid (low volatile)
dicamba + 2, 4-D + mecoprop ..... (Banvel 3), Kil-mor,
2, 4-dichlorophenoxyacetic acid (low volatile) ..... 2, 4-D Amine
Diclofop ..... Hoe-Grass, Methyl
DNBP (dinoseb amine) ..... Premerge, Sinox P.E., Yellowstuff
Dowpon ..... dalapon, Basfapon
Dual-Ciba Geigy ..... Metalachlor
Dyanap ..... Naptalam + Dinoseb
Eptam ..... EPTC
EPTC ..... Eptam
EPTC + R25788 ..... Eradicane
Eradicane ..... EPTC + R25788
Glyphosate ..... Round-up
Gramoxone ..... paraquat
Hoe Grass ..... Diclofop methyl
ioxynil ..... Totril
Kil-mor ..... dicamba + 2, 4-D + mecoprop, Banvel 3
Lasso ..... Alachlor
linuron ..... Afolan, Lorox L
Lorox L ..... linuron, Afolan
Metalachlor ..... Dual-Ciba-Geigy
Metalachlor + atrazine ..... Primextra
Metribuzen ..... Sencor
Naptalam ..... Alanap
paraquat ..... Gramoxone
Pardner ..... bromoxynil octonoate, Torch
Prefar ..... bensulide
Premerge ..... DNBP (dinoseb amine), Sinox P.E., yellowstuff
Primextra ..... metalachlor + atrazine
Princep-Nine-T ..... simazine, Simazine 80, Princep 80W
Princep 80W ..... simazine, Simazine 80W, Princep-Nine-T
Ro-Neet ..... cycloate
Roundup ..... Glyphosate
Sencor ..... Metribuzen

Simazine ..... Princep 80W, Simazine 80W, Princep-Nine-T
Simazine 80W..... simazine, Princep 80W, Princep-Nine-T
Sinox P.E. ..... DNBP (dinoseb amine), Premerge, yellow-stuff
Sodium TCA ..... Trichloroacetic acid
stoddard solvent ..... Agricultural Weed Killer No. 1
Sutan ..... butylate
Torch ..... bromoxynil octanoate, Pardner
Totril ..... ioxynil
Treflan ..... trifluralin
Trichloroacetic acid ..... Sodium, TCA
trifluralin ..... Treflan
yellowstuff ..... Dinoseb

Insecticides

Ambush ..... permethrin
azinphos-methyl ..... Guthion
Bacillus thuringiensis ..... Thuricide, Dipel
Belmark ..... fenvalerate
Birlane ..... chlorfenvinfos
carbofuran ..... Furadan
carbaryl ..... Sevin
chlorfenvinfos ..... Birlane
chlorpyrifos ..... Lorsban
Cygon ..... dimethoate, Rogor
Dasanit ..... fensulfothion
Decis ..... deltamethrin
deltamethrin ..... Decis
Diazinon ..... diazinon
diazinon ..... Diazinon
dimethoate ..... Cygon, Rogor
Dipel ..... Bacillus thuringiensis, Thuricide
Dyfonate ..... fonofos
endosulfan ..... Thiodan
fensulfothion ..... Dasanit
fenvalerate ..... Belmark
fonofos ..... Dyfonate
Furadan ..... carbofuran
Guthion ..... azinphos-methyl
Lannate ..... methomyl
lindane ..... lindane
Lorsban ..... chlorpyrifos
Malathion ..... malathion
malathion ..... Malathion
metaldehyde ..... metaldehyde
methamidophos ..... Monitor
methidathion ..... Supracide
methomyl ..... Lannate
Monitor ..... methamidophos
permethrin ..... Ambush
phorate ..... Thimet
Rotenone ..... Rotenone
Supracide ..... methidathion
Thimet ..... phorate
Thiodan ..... endosulfan
Thuricide ..... Bacillus thuringiensis, Dipel

Molluscicides

metaldehyde ..... Slug Bait

Sprout Inhibitors

maleic hydrazide MH-30

Top-Killers

dinoseb ..... Dytop, Dow general liquid with oil
diquat ..... Reglone
Dow General liquid with oil ..... dinoseb; Dytop
Dytop ..... dinoseb, Dow General liquid with oil
Reglone ..... diquat

Relative Mammalian Toxicity of Pesticides

To simplify information, brand or trade names of products have been used. No endorsement is intended, nor is criticism implied of similar products not mentioned. Only products recommended in this guide are listed.

Rubber gloves should be worn when handling and mixing any pesticide in concentrate form. Protective equipment such as an approved agricultural respirator, rubber gloves and goggles should be worn when handling, mixing or applying a pesticide marked with an *.

Very Toxic

Oral (by mouth) LD 50, 0-50

A.W.K. # 1 (stoddard solvent, mineral oil)*
Birlane (chlorfenvinphos)*
Dasanit (fensulfothion)*
Dow General (dinoseb)*
Furadan (carbofuran)*
Gramoxone (paraquat)*
Guthion (azinphos-methyl)*
Lannate (methomyl)*
Monitor (methamidophos)*
Premerge (dinoseb amine)*
Sinox P.E. (dinoseb amine)*
Supracide (methidathion)*
Thimet (phorate)*
Yellow Stuff (dinoseb)

Dermal (skin absorption) LD 50, 0-200

Birlane (chlorfenvinphos)*
Dasanit (fensulfothion)*
Dow General (dinoseb)*
Dytop (dinoseb)*
Monitor (methamidophos)*
Premerge (dinoseb amine)*
Sinox P.E. (dinoseb amine)*
Supracide (methidathion)*
Thimet (phorate)*
Totril (ioxynil)*
Yellow Stuff (dinoseb)

Moderately Toxic

Oral (by mouth) LD 50, 50-500

Banvel 3, Kil-mor (dicamba + 2, 4-D + mecoprop)

Basagran (bentazon)
Belmark (fenvalerate)
copper, fixed
copper sulphate (bluestone)
Cygon (dimethoate)
2, 4-D
Decis (deltamethrin) — eye irritant
diazinon
Dyfonate (fonofos)
Kil-mor, Banvel 3 (dicamba + 2, 4-D + mecoprop)
lindane*
Lorsban (chlorpyrifos)*
Mertect (thiobendazole)
Neutro-cop (fixed copper)
Pardner, Torch (bromoxynil)
Reglone (diquat)
Rogor (dimethoate)
rotenone
Sevin (carbaryl)
Thiodan (endosulfan)*
Torch, Pardner (bromoxynil)
Totril (ioxynil)*

Dermal (skin absorption) LD 50, 200-1000

Cygon (dimethoate)
diazinone
Gramoxone (paraquat)*
Guthion (azinphos-methyl)*
lindane*
Lorsban (chlorpyrifos)*
Mertec (thiobendazole)
Reglone (diquat)
Rogor (dimethoate)
Thiodan (endosulfan)*

Slightly Toxic

Oral (by mouth) LD 50, 500+

Aatrex (atrazine)
Afolan, Lorox (linuron)
Alanap (naptalam)
Ambush (permethrin)
Amitrol T, Cytrol (amino triazole)
Arasan (thiram)
Bacillus thuringiensis (Dipel, Thuricide)
Basfapon (dalapon)
Benlate (benomyl)
Bravo (chlorothalonil)
Captan (captan)
CIPC (chloropropham)
Cytrol, Amitrol T (amino triazole)
Difolatan (captafol)
Dipel (Bacillus thuringiensis, Thuricide)
Dithane M-22, Dithane M-45 (maneb, mancozeb)
Dithane Z-78 (zineb)
Dowpon (dalapon)
Dyanap (naptalam + dinoseb)
Dyrene (anilazine)
Easout (thiophanate-methyl)
Eptam (EPTC)
Eradicane (EPTC + R25788)
Hoe Grass
Lasso (alachlor)
Lorox, Afolan (linuron)
Malathion
Manzate D (maneb)
Manzate 200 (mancozeb)
Mertect (thiobendazole)
metaldehyde
MH-30 (maleic hydrazide)
Orthocide (captan)
Polyram (metiram)
Prefar (bensulide)
Primextra (metalachlor + atrazine)
Princep, Simazine 80W (simazine)
Pro Gro (carbothiin, thiram)
Ro-Neet (cycloate)
Roundup (glyphosate)
Sencor (metribuzen)
Sutan (butylate)
TCA (sodium trichloroacetic acid)
thiram
Thuricide (Bacillus thuringiensis)
Treflan (trifluralin)
zineb

Dermal (skin absorption) LD 50, 1000+

Aatrex (atrazine)
Afolan, Lorox (linuron)
Alanap (naptalam)
Ambush (permethrin)
Amitrol T, Cytrol (amino triazole)
Arasan (thiram)
A.W.K. #1 (stoddard solvent, mineral oil)*
Bacillus thuringiensis (Dipel, Thuricide)
Banvel 3, Kil-mor (dicamba + 2, 4-D + mecoprop)
Basagran (bentazon)
Basfapon (dalapon)
Belmark (fenvalerate)
Benlate (benomyl)
Bravo (chlorothalonil)
Captan (captan)
CIPC (chloropropham)
copper, fixed
copper sulphate (bluestone)
Cytrol, Amitrol T (amino triazole)
2, 4-D
Decis (deltamethrin) — eye irritant
Difolatan (captafol)
Dipel (Bacillus thuringiensis)
Dithane M-22, Dithane M-45 (maneb, mancozeb)
Dithane Z-78 (zineb)
Dowpon (dalapon)
Dyanap (naptalam + dinoseb)
Dyfonate (fonofos).
Dyrene (anilazine)
Easout (thiophanate-methyl)
Eptam (EPTC)
Eradicane (EPTC + R25788)
Furadan (carbofuran)*
Hoe Grass (diclofop methyl)
Kil-mor, Banvel 3 (dicamba +2, 4-D + mecoprop)
Lasso (alachlor)
Lorox, Afolan, (linuron)
Lorsban (chlorpyrifos)
Malathion
Maloran (chlorbromuron)

Manzate D (maneb)
Manzate 200 (mancozeb)
Mertect (thiobendazole)
metaldehyde
MH-30 (maleic hydrazide)
Neutro-Cop (fixed copper)
Orthocide (captan)
Pardner, Torch (bromoxynil)
Polyram (metiram)
Prefar (bensulide)
Primextra (metalachlor + atrazine)
Princep, Simazine 80W (simazine)
Pro-Gro (carbothiin, thiram)
Ro-Neet (cycloate)
rotenone
Roundup (glyphosate)
Sencor (metribuzen)
Sevin (carbaryl)
TCA (sodium trichloroacetic acid)
Sutan (butylate)
thiram
Thuricide (Bacillus thuringiensis)
Torch, Pardner (bromoxynil)
Treflan (trifluralin)
Tri-Cop (fixed copper)
zineb

Winter Storage of Pesticides

I. Herbicides

A. Herbicides which must be kept in heated storage (DO NOT FREEZE)

Agriculture Weedkiller No. 1
Afolan F
Amitrol-T
Alanap 3
Banvel
Basagran
Chloro-IPC (CIPC)
Dyanap
Dytop
Dyvel
Gramaxone
Hoe Grass
Kil-Mor
Lasso
Lorox L
Pardner
Potato Top Killer 300
Prefar
Premerge 360
Randox
Reglone
Ro-Neet 7.2E
Simadex
Sinox PE
TCA Solution
Torch
Totril
2,4-D Amine
Yellow Stuff PE

B. Herbicides which may be stored at freezing temperatures. These must be returned to their original state by warming to room temperature 20 to 22°C, and agitating thoroughly before use.

AAtrex Liquid
AAtrex Plus
Atrazine Liquid
Dual-Ciba-Geigy
Dytop
Eptam 8-E
Eradicane 8-E
Primextra
Roundup
Sencor 500
Sutan +
Treflan EC

C. Herbicides normally sold as granules or powders: (These are not usually damaged by freezing). Store in dry place.

AAtrex WP
AAtrex Nine-O
Atrazine 80W
Basfapon
Bluestone
Dalapon
Dowpon
Dowpon M
Eptam 10G
Nata TCA
Princep-Nine-T
Sencor 50WP
Simadex 80W
TCA
Treflan QR5

II. Fungicides

Store liquids in a dry location with a temperature of 3-4°C. Store granules, powders, etc. materials in a dry location. Freezing temperatures are not detrimental to granular or powder formulations.

III. Insecticides

Store liquids in a dry location with a temperature of 3-4°C. Store granules, powders, etc. materials in a dry location. Freezing temperatures are not detrimental to granular or powder formulations.

Residue Tolerances and Days to Harvest

Tolerances for residues of agricultural chemicals on vegetables when offered for sale have been set by the Department of National Health and Welfare, Ottawa.

To avoid exceeding the residue tolerance for insecticides, herbicides and fungicides:

- DO NOT APPLY THEM LATER THAN RECOMMENDED.

- DO NOT APPLY THEM MORE OFTEN THAN RECOMMENDED ON THE LABEL.
- DO NOT APPLY MORE THAN THE RECOMMENDED AMOUNT.

Pre-Harvest Wait Periods for Fungicides

Basi-Cop, Tri-Cop, Neutro-Cop, Kocide 101	fixed coppers	Snap Beans	1 day
		Cucumbers	1 day
		Pumpkins	1 day
		Squash	1 day
		Potatoes	1 day
		Tomatoes	1 day
Bravo (chlorothalonil)		Snap Beans	14 days
		Carrots	0 days
		Cucumbers	0 days
		Pumpkins	0 days
		Squash	0 days
		Snap Beans	14 days
		Carrots	1 day
		Celery	7 days
		Cucumbers	1 day
		Pumpkins	1 day
		Squash	1 day
		Potatoes	1 day
		Tomatoes	1 day
Dithane M-22, Manzate D	(maneb)	Carrots	5 days
		Potatoes	1 day
		Tomatoes	1 day
Dithane M-45, Manzate 200	(mancozeb)	Carrots	7 days
		Potatoes	1 day
		Tomatoes	1 day
Dithane Z-78 (zineb)		Asparagus	Do not apply to spears.
		Carrots	5 days
		Tomatoes	5 days

For additional information refer to Table 3.

Pre-Harvest Wait Periods for Insecticides

Ambush (permethrin)	Cabbage, Cauliflower	3 days
	Brussel Sprouts	3 days
	Broccoli	7 days
	Potatoes	1 day
	Sweet Corn	1 day
Belmark (fenvalerate)	Cabbage, Cauliflower,	14 days
	Brussel Sprouts,	14 days
	Broccoli	14 days
	Potatoes	7 days
Cygon, Rogor (dimethoate)	Beets (Red)	12 days
	Cabbage, Cauliflower,	4 days
	Broccoli	4 days
	Brussel Sprouts	21 days
	Peppers	3 days
	Potatoes	7 days
Diazinon (diazinon)	Beets (Red)	14 days
	Broccoli, Cauliflower	5 days
	Brussel Sprouts	14 days
	Cabbage	7 days
	Onions	10 days
	Radish	10 days
	Rutabaga	14 days
Dasinit (fensulfothion)	Onions	45 days
	Rutabaga	40 days
Decis (deltamethrin)	Broccoli	7 days
	Cabbage	7 days
	Potatoes	23 days
Furadan (carbofuran)	Potatoes	7 days
	Rutabaga	40 days
Guthion (azinphos methyl)	Potatoes	7 days
Lannate (methomyl)	Cauliflower	7 days
	Broccoli	7 days
	Brussel Sprouts	7 days
	Cabbage	1 day
	Sweet Corn	3 days
Lorsban (chlorpyrifos)	Broccoli,	40 days
	Brussel Sprouts	40 days
	Cabbage	40 days
	Green Peppers	40 days
	Carrots	60 days
	Caulitlower	40 days
	Bulk Onions	60 days
	Tomato	70 days
	Potato	70 days
	Celery	70 days
	Rutabagas	30 days
	Cucumbers	60 days
Malathion (malathion)	Beans (snap)	1 day
	Beets (red)	7 days
	Cabbage	7 days
	Cauliflower	7 days
	Brussel Sprouts	7 days
	Broccoli	3 days
	Celery	7 days
	Eggplant	3 days
	Cucumbers	3 days
	Lettuce (leaf)	14 days
	Lettuce (head)	3 days
	Potatoes	3 days
	Radish	7 days
	Rutabagas	7 days
	Tomatoes	3 days
	Pepper	3 days
Monitor (methamidophos	Cabbage	7 days
	Cauliflower	7 days
	Broccoli	14 days
	Brussel Sprouts	14 days
	Potatoes	14 days
Rotenone	Cucumbers	1 day
	Pumpkin	1 day
	Squash	1 day
Sevin (carbaryl)	Sweet Corn	1 day
	Eggplant	1 day
	Potatoes	7 days
	Radish	7 days
	Beans (snap)	3 days
	Celery	3 days
	Carrots	1 day
	Lettuce (head)	3 days
	Lettuce (leaf)	14 days
	Tomatoes	1 day
Supracide (methidathion)	Potatoes	14 days
Thiodan (endosulfan)	Cabbage	7 days
	Caulifower	7 days
	Broccoli	7 days
	Brussel Sprouts	7 days
	Cucumbers	2 days
	Eggplant	2 days
	Potatoes	1 day
	Rutabagas	45 days
	Tomato	2 days
	Beans (snap)	2 days
	Celery	14 days
	Corn (sweet)	50 days

Peppers	2 days
Pumpkin	2 days
Squash	2 days
Cucumber	2 days
Head Lettuce	14 days

Bee Poisoning

Pollinating insects, especially honeybees and wild bees are necessary for the production of some vegetable crops. It is therefore important for the grower to refrain as much as possible from poisoning bees foraging on these crops when bloom is present.

An insecticide application on any crop which is likely to poison neighborhood bees should be of concern to a vegetable grower.

The following are a few points to consider and remember in the prevention of bee poisoning.

1. Do not spray any flowering crop on which bees are foraging. If insecticides must be applied, spray in the early morning or in evening when bees are not foraging. Bees usually do not forage at temperatures under 13°C.
2. If it is necessary to apply an insecticide poisonous to bees when they are foraging, notify neighboring beekeepers so they may protect their bees.
3. Do not apply insecticide on windy days as drift toward any nearby beehives may cause poisoning.
4. Ground applications are generally less hazardous than aircraft applications and there is usually less drift.
5. Where there is a choice and bees will possibly be poisoned choose the formulation less hazardous to bees. Dusts are more toxic than sprays. EC formulations are less toxic than WP formulations.

Note: *Most organophosphate and carbamate insecticides are highly toxic to bees. Those insecticides used in vegetable production and which are toxic to bees are listed below:*

Relative Toxicity of Insecticides to Honeybees

Group 1—Very toxic: Do not apply to flowering crops or weeds.

Ambush (permethrin)
Belmark (fenvalerate)
Dasanit (fensulfothion)
Diazinon (Diazinon)
Dimethoate (Cygon, Rogor)
Furadan (carbofuran)
Guthion (azinphosmethyl)
Lannate (methomyl)
Lorsban (chlorpyrifos)
Malathion (malathion)
Monitor (amidophos)
Sevin (carbaryl)
Supracide (methidathion)

Group 2— Apply only during late evenings or early morning when bees are not foraging. See note below.

Thiodan (endosulfan)

Note: *Unusually low temperatures at time of application may cause insecticides to remain toxic up to 20 times longer than during reasonably warm weather. High temperatures in the early morning or late evening may extend active foraging by bees and adversely affect bees on treated crops.*

ALL OTHER INSECTICIDES LISTED IN THIS GUIDE CAN BE APPLIED AT ANY TIME WITH REASONABLE SAFETY TO BEES.

Effect of Rainfall on Herbicide Efficacy

Rainfall shortly after application of a postemergence herbicide may reduce weed control. This table summarizes available information.

Product	Interval Required*
Torch	30 minutes
Pardner	30 minutes
Hoe Grass	1 hour
TCA	1 hour
Dalapon	4 hours
2,4-D Amine	4 hours
Banvel, Dyvel	4 hours
Roundup	6 hours
Sencor	6 hours
Kil-mor	6 hours
Basagran	8 hours
Amitrol-T	8 hours

Gramoxone— very rapidly absorbed by foliage. Very resistant to removal by rain.

* *Time required between application and rainfall to avoid against significant reduction in efficacy.*

Soil Residues — Herbicides

Some herbicides recommended for vegetable crops leave a residue in the soil, affecting subsequent crops in the rotation. This table summarizes available information. Refer to product labels for specific information.

Product	Vegetable Crops Which May Be Affected The Following Year
Atrazine (includes all products containing atrazine)	All crops except corn. Flax, peas and faba beans have some tolerance to atrazine residues. If rate of application exceeds 1.1 kg/ha active (1.0 lb/acre) only corn should be grown the following year. Atrazine residues may persist for more than one year.
Primextra	All crops except corn. Primextra contains atrazine. See comment for atrazine.

Princep Nine-T Simadex, Simazine	All crops except asparagus. Soil residues may persist for two or more years.
Sencor (preplant)	All crops except potatoes
Sinbar	All crops except established alfalfa as recommended. Sinbar residues may persists for two or more years.
Treflan	Red Beets, Cucumbers, onions, parsnips and potatoes. Corn may also be sensitive to higher rates of application.

Herbicides and Liquid Fertilizer Compatibility

The mixing of herbicides in liquid fertilizer for application should be carried out only for products which are recommended for this use.

Thorough mixing and even application are required. Accurate calibration should be carried out to ensure the proper rate of herbicide application.

Compatibility of the herbicide in the liquid fertilizer should be tested before the herbicide is added to the tank. All registered products outline this procedure.

The following vegetable crop herbicides can be applied with liquid fertilizer:

Aatrex	Eradicane 8-E
Primextra	Ro-Neet,7.2E
Dual-Ciba-Geigy	Sutan (alone or with Aatrex)
Eptam	Treflan

General Pesticide Recommendations

Slugs For control on most vegetable crops apply metaldehyde. Order ahead of time since companies do not generally stock supplies. Material should not be held over as it deteriorates quite rapidly.

Cutworms Apply Lorsban 4C at 1.5 to 3 L/ha (1 to 2 pints/acre) or Ambush 500 EC at 0.14 L/ha (2.0 fluid ounces/acre) under good moisture conditions. Under dry conditions or when cutworm larvae are large and almost mature apply 0.23 to 0.30 L/ha (3.2 to 4.3 fluid ounces/acre). Ambush is registered for use in seedling and/or transplanted asparagus, beets, carrots, cole crops, lettuce, onions, peppers and potatoes. Consult label or page 9 for information on waiting periods to harvest.

Grasshoppers Apply Malathion 50 EC at 1.7 L/ha (24 fluid ounces/acre).

For Proper Pesticide Use

- Identify the Pest Problem
- Use the Recommended Pesticide
- Apply According to Directions

General Fertility Recommendations

Most crops when the available nutrient level of soil is low, respond well to fertilizer. Stubble fields are usually low in nitrogen and phosphorus. Fallow fields usually have adequate nitrogen but are low in phosphorus. Many fields may be low in sulphur and some may also be low in potassium. On the other hand, where high rates of fertilizer have been used for a number of years the level of available nutrients may be adequate to meet crop requirements.

Recommendations for maximum rates of fertilizer which can safely be applied with the seed have been established with granular fertilizers using double disc drill seeding equipment. Using this method, fertilizer is placed in close proximity to the seed. Discers, hoe-drills and air seeders vary in their ability to accurately place seed and fertilizer. This means some discretion may be used in increasing recommended maximum rates of fertilizer with the seed if contact between fertilizer and seed is less than that with a double disc drill. Safe rates of fertilizer, applied with the seed may also be found to increase if it is applied in solution form rather than as granular fertilizer.

For specific recommendations on individual fields, have your soil analyzed. Details of sampling procedures may be obtained from your agricultural representative's office or your fertilizer dealer. Cost of routine testing ranges from $7.00 to $14.00 depending on tests required. Send your soil sample to:

Provincial Soil Testing Laboratory
Department of Soil Science
University of Manitoba
Winnipeg, Manitoba R3T 2N2

For further details, see Manitoba Agriculture Fact Sheet "*Soil Testing Services in Manitoba*" Agdex 533.

Major Nutrients For Annual Crop Production

Nitrogen Nitrogen fertilizer is effective in increasing both yield and protein content. Its value in increasing yield and/or protein content is significantly affected by the time of application and method of placement. The various nitrogen carriers appear to be equally effective in increasing yields and/or protein content of annual crops when applied so that nitrogen losses are minimized. The greatest efficiency of all nitrogen fertilizers is obtained when the fertilizers are banded into the soil or applied in the seed row.

Urea and liquid or dry fertilizers containing urea should be well covered with soil to minimize losses. Apply anhydrous ammonia and aqueous ammonia at depths of 10 to 15 cm (4 to 6 inches) when soil conditions permit a good seal behind the applicator shanks. When crop is seeded less than five days after applying anhydrous ammonia and aqua ammonia, damage may occur specifically on sandy soil or under dry conditions.

The relative efficiency of nitrogen fertilizers as affected by time of application and method of placement varies greatly from year to year. *The average relative value of times and methods of application, when spring broadcast nitrogen is given a value of 100, can be calculated and are as follows:*

Time and Method	Relative Value
Spring broadcast	100
Spring banded	120
Fall broadcast	82
Fall banded	93

For further details, see the Manitoba Agriculture fact-sheet *Nitrogen Fertilization in Crop Production*, Agdex 541.

Phosphorus Most Manitoba soils are phosphorus deficient and will give yield responses to fertilizer phosphorus application. A crop's response to phosphorus is affected by factors such as root development and distribution, the plant's ability to take up soil and fertilizer phosphorus, the method of phosphorus application, the soil available phosphorus level, soil type (soil texture, pH and carbonate content), soil water and temperature.

Ideally, plants should have a good supply of phosphorus close to the seed during the first month of growing and an adequate quantity of phosphorus in the soil for the rest of the season. Placing sufficient quantities of phosphorus with the seed or close to the seed have been the traditional methods for phosphorus fertilization of annual crops in Manitoba. They have been found to satisfy both early growth requirements and provide a reserve of phosphorus for the balance of the growing season.

CAUTION: By increasing the phosphorus applied annually above that normally recommended (banded or broadcast) an increase in soil available phosphorus results. Thus, a farmer could increase soil available phosphorus to high or very high levels so that yields would not be significantly affected by phosphorus deficiency. The number of applications or years of phosphorus fertilizer required to increase soil available phosphorus to high or very high levels is unknown for most soils. Soil testing at regular intervals is a good way to monitor the available phosphorus level.

High rates of applied fertilizer phosphorus (annual rates in excess of 150 kg/ha (134 lb/acre) of P_2O_5) may induce a micro-nutrient deficiency if soil levels of micro-nutrients are marginal (for example, zinc and copper).

Phosphorus Banded with the Seed Banding of fertilizer phosphorus with the seed results in the greatest yield increase per unit of phosphorus for all crops provided that the amount applied is not injurious to the germinating seedling. Some crops will tolerate all their fertilizer phosphorus requirements placed with the seed.

Phosphorus Banded Near the Seed Banding fertilizer phosphorus near the seed (beside and/or below) results in the greatest yield increase per unit of phosphorus when amounts in excess of those tolerated with the seed are required.

Phosphorus Deep-Banded Deep banded phosphorus; phosphorus banded at about the 10 to 15 cm (4 to 6 inches) soil depth and in spacings of 30 cm (12 inches) or less prior to seeding is more effective in increasing yields than phosphorus broadcast and incorporated. Applications of nitrogen with the phosphorus should increase the availability of fertilizer phosphorus.

Note: Take care not to disturb the phosphorus bands during tillage and seeding operations.

Phosphorus Deep-Banded with Nitrogen Nitrogen applied with phosphorous will increase fertilizer phosphorous availability. Band these fertilizers together when both nitrogen and phosphorus are needed. Application of 10 to 15 kg (9-13 lbs/ac.) P_2O_5/ha with or near the seed may also be required to insure adequate supplies of phosphate for early growth.

Phosphorus Surface Applied and Incorporated Surface incorporation of fertilizer phosphorus results in the lowest yield increase per unit of phosphorus. As a result the amount applied broadcast must be greater than amounts applied with or near the seed to obtain equal yield increases in the year of fertilizer application.

Since the amount of phosphorus applied during the first number of years has to be increased two or fourfold to equal yield increases from placement near the seed, broadcast application of phosphorus may be uneconomic on many soils.

For further details, see the Manitoba Agriculture fact-sheet *Phosphorus Fertilization in Crop Production and Phosphorus Application for Annual Crops.*

Potassium Most Manitoba soils contain sufficient available potassium for most cropping situations. Soils which are most likely to contain insufficient potassium are the coarse textured soils (sands to sandy loams) and organic soils. Additional fertilizer potassium may be required on about 5 to 7 per cent of arable Manitoba soils for maximum production of the commonly grown annual crops such as cereals, rapeseed, and flax. From 25 to 40 per cent of soils used for production of special annual crops such as corn, potatoes and sugarbeets and the horticultural fruit and vegetable crops may require additional potassium. The application of potassium where required, can increase crop yield and quality and, depending on the type of crop, can increase frost and disease resistance, palatability, storage, quality, etc. A soil test is recommended to determine if a potassium application is needed in any specific situation.

Within the limits allowable for each crop, place potassium fertilizers in the seed row or side banded whenever possible for most efficient use of fertilizer by annual crops. The efficiency of broadcast potassium is about one-half of that applied with the seed. If potassium is to be broadcast, the rate of application should be double that of the rate recommended for seed placement or side banding to obtain equal crop response. If broadcast, potassium fertilizer should be incorporated into the soil.

Sulphur For many years it has been recognized that well drained sandy soils and grey luvisol (grey wooded)

soils may be sulphur deficient. More recent results of soil analyses indicate that sulphur deficiency occurs in many other soils and in most areas of the province. Because of this it is recommended that farmers have a soil test to establish the available sulphur status of their fields.

Crops vary greatly in their sulphur requirements. Rapeseed, mustard, corn, potatoes, sugarbeets, horticultural crops, and forages containing a legume component have a higher sulphur requirements than crops such as cereal grains and flax. Sulphur deficiencies are more likely to occur with crops having a high sulphur requirement. These crops also have a greater tendency to deplete the sulphur in the soil resulting in a low supply of available sulphur for subsequent crops. This is particularly true following breaking of a perennial forage stand.

Sulphur fertilizer recommendations are based on sulphur being applied in the sulphate ($SO_4=$) form as this is the only form which is readily available to plants. Some nitrogen and phosphorus containing fertilizers also contain sulphate sulphur, for example, 21-0-0 (24S) and 16-20-0 (14S). Sulphur in the elemental form, as it occurs in some fertilizers, is not available to plants until it has been oxidized to the sulphate form.

Sulphur in the elemental form, as it occurs in some high analysis sulphur products such as flaked or prilled elemental sulphur (99% S), flowers of sulphur (99% S) or granular sulphur (90% S) is not available to plants until oxidized to the sulphate form. Oxidation of sulphur requires time and depends on soil temperature and moisture, size of sulphur granule and the rate at which granules break down in the soil. Recent research has found that sulphur from these products does not become available in sufficient quantities to meet crop requirements in the year of application. Therefore, they are not recommended to be applied on soils with a low available sulphur content where the crops would require the applied sulphur to be available in the immediate year of application.

Ammonium thiosulphate is a liquid formulation (12-0-0 26)) containing 26 per cent sulphur by weight. One-half of the sulphur converts into the readily available sulphate form and the remainder into finely divided elemental sulphur. This product can be applied to supply sulphur at the rate recommended for sulphate sulphur.

Micro-Nutrients Most of Manitoba's mineral soils contain sufficient micro-nutrients for most crops. Do not apply micro-nutrient fertilizers unless it is established that deficiences exist. Consult with extension agronomists and make use of soil test results.

The Manitoba Soil Testing Laboratory offers a soil micronutrient analysis service. The cost for a copper-zinc-iron-manganese soil analysis is $7 per field, if in addition to a routine soil test, these tests are performed only when specifically requested. Proper soil sampling and sample handling procedures are important.

Additional information is contained in the Manitoba Agriculture factsheet *Micro-nutrients in Crop Production*, Agdex 541.

The Manitoba Soil Testing Laboratory offers a Plant Tissue Analysis Service. Plant tissue analysis is useful in evaluating fertilizer management programs and practices, diagnosing nutrient related crop production problems, and identifying nutrient levels incrops that may limit top yield achievement. Plant Tissue Analysis is particularly useful in evaluating and identifying potential micronutrient problems.

The cost of a Plant Tissue Analysis ranges from $3.50 per sample for an individual nutrient analysis to $16.50 for a complete 10 nutrient analysis. Proper plant sampling and sample handling procedures are important.

Detailed information and Plant Tissue Analysis and complete instructions for sampling procedures are contained in the Manitoba Agriculture factsheet *Plant Tissue Analysis*, Agdex 533.

Organic Soils Most organic soils are very deficient in phosphate and potassium. Farmers on organic soils should use the higher rates of phosphate and potassium recommended in this booklet for each crop.

Organic soils are frequently deficient in copper and may also be deficient in manganese and boron. Use both soil and plant analyses as aids in determining if these micro-nutrients are deficient. Conduct small scale trials (micro-nutrients applied to portions of a field) to assess the effects of micro-nutrient fertilizers on crop yields before micro-nutrients are used on large land areas. Recommendations for micro-nutrient fertilizer use in these trials and in instances where deficiencies exist are:

Copper Apply 5 to 15 kg/ha (4 to 13 lb/acre) copper, (for example, 20 to 60 kg/ha, 18 to 54 lb/acre copper sulphate). Spray dissolved copper sulphate and incorporate well into the surface 15 cm (6 inches) of soil. Research indicates that applying copper fertilizer in the solution form is superior to its application in granular form. After soils have been fertilized two or three times with copper, have both a soil and a plant analyses to determine if excessive copper accumulation has occurred.

Manganese 10 to 15 kg/ha (9 to 13 lb/acre) manganese, (for example, 40 to 60 kg/ha, 36 to 54 lb/acre manganese sulphate) should be drilled with the seed of cereals and banded away from the seed of rapeseed and grasses.

Boron Incorporate 1 to 2 kg/ha (1 to 2 lb/acre) boron, (for example, 9 to 17 kg/ha, 8 to 15 lb/acre borox) with the surface 15 cm (6 inches) of soil.

Calculation of Fertilizer Rates Fertilizers are labelled by percentage according to their guaranteed minimum analysis in terms of Nitrogen (N), phosphoric (P_2O_5) and potash (K_2O).
For example, 11-48-0 (2) contains 11 per cent nitrogen by weight, 48 per cent phosphate by weight and 0 per cent potash by weight, and approximately 2 per cent sulphur by weight. Thus, the actual weight of nutrients in 100 kg of fertilizer is: N = 11 kg. P_2O_5 = 48 kg and K_2O = 0 kg, and S = 2 kg (approximately).
For example:

1. Using 11-48-0 (2)
   Rate of P_2O_5 desired 22 kg/ha

   $$\text{Rate of fertilizer} = \frac{22 \times 100}{48} = 46 \text{ kg/ha}$$

46 kg/ha of 11-48-0 (2) would also supply nitrogen at the rate of

$\frac{11 \times 46}{100} = 5.1$ kg/ha and sulphur at the rate of

$\frac{2 \times 46}{100} = 0.9$ kg/ha

2. Using 34-0-0

Rate of N desired = 45 kg/ha

Rate of fertilizer required = $\frac{45 \times 100}{34}$ =

132 kg/ha

Fertilizer Analysis

Note: *The number in brackets denotes the approximate percentage of sulphur in the fertilizer.*

Liquids (solutions)

Ammonium phosphate	10-34-0
Nitrogen solution	28-0-0, 32-0-0
Aqua ammonia	20-0-0
Ammonium Thiosulphate	12-0-0 (26)

Gas (compressed)

Anhydrous ammonia	82-0-0

Dry (solids)

Ammonium phosphate	11-51-0; 11-55-0; 11-48-0 (2)
Ammonium phosphate sulphate	16-20-0 (14)
Urea ammonium phosphate	19-39-0
Diammonium phosphate	18-46-0
Ammonium nitrate phosphate	23-23-0; 23-24-0; 24-24-0; 25-25-0
Urea ammonium phosphate	27-27-0; 34-17-0
Ammonium nitrate phosphate sulphate	26-13-0 (13)
Ammonium nitrate phosphate	27-14-0; 28-14-0
Ammonium sulphate	21-0-0 (24)
Ammonium nitrate	34-0-0
Urea-ammonium sulphate	34-0-0 (11)
Sulfur-coated urea	40-0-0 (11)
Urea	46-0-0
Mixed fertilizers	8-24-24 (3); 8-25-25; 10-30-10 (5); 10-34-10; 17-17-17
Potassium chloride	0-0-62
Potassium chloride	0-0-60
Calcium sulphate (gypsum)	0-0-0 (13-19)
Sulphur (clay base)	0-0-0 (90)

In addition to these pre-mixed fertilizers, micronutrients and blended fertilizers including suspensions are available from some fertilizer dealers.

Weed Control

Stale Seedbed

Crops Beans (all types), beets, brussel sprouts, carrots, cabbage, cauliflower, corn, cucumber, kale, onion, peas, potatoes, rutabagas.

Method Prepare seedbed two to four weeks before seeding to stimulate weed growth. Seed without further cultivation and with minimum disturbance of the soil. Emerged weeds must be burned off with Gramoxone either before or shortly after seeding, but no later than three days before the crop will emerge.

Gramoxone (200 g/L, 2.00 lb/gal) Controls annual grasses and broadleaf weeds and top growth of perennial weeds. Apply 2.75 to 5.5 L/ha (0.98 to 1.96 qt/acre) in in 300 to 1100 L/ha (26.7 to 97.9 gal/acre) clean water preemergent to the crop, postemergent to the weeds. Use the higher rate when weeds are above 5 cm (2 inches) in height, and the higher volume of water on dense weed growth.

Asparagus

Varieties

Mary Washington

Seedling Production

Plant seed 2.5 to 3.8 cm (1 to 1-½ inches) deep, and 9 to 10 cm (3 to 4 inches) apart in rows 45 to 60 cm (18 to 24 inches) apart. 1.1 kg/ha (one pound) of seed should be sufficient to provide crowns for one acre. Use only strong, vigorous one year old roots (crowns) for transplanting.

Transplanting and Spacing

In the early spring following seeding, dig the year old plants and select those which have at least 10 roots. Choose fertile land that is well drained. For transplanting open a furrow 15 to 20 cm (6 to 8 inches) deep. Space plants 30 to 45 cm (12 to 18 inches) apart in rows 120 to 150 cm (4 to 5 feet) apart. Spread the roots and cover with 5 cm (2 inches) of well firmed soil. Fill the furrow gradually by cultivating as the plants grow until the furrows have been filled level with the field.

Fertilizer

Pre-Planting of Crowns Apply a liberal application of manure (27273 kg or 30 tons) and 224 kg/ha 11-48-0 (200 lb/acre). Without manure apply 112 kg/ha (100 lb/acre) nitrogen, 112 kg/ha (100 lb/acre) phosphorus (P_2O_5) and 112 kg/ha (100 lb/acre) potash (K_2O).

Established Beds Apply annually, immediately after final harvest, 112 kg/ha (100 lb/acre) N, and 56 kg/ha (50 lb/acre) P_2O_5. If on light sandy soils, increase N to 168 kg/ha (150 lb/acre), P_2O_5 to 89 kg/ha (80 lb/acre) and add 67 kg/ha (60 lb/acre) K_2O.

Weed Control

Before spear emergence or after last cutting.

Afolan F (450 g/L, 4.5 lb/gal), Lorox L (480 g/L, 4.8 lb) Controls barnyard grass, green and yellow fox-

tail and several broadleaf weeds. (Table 1) Apply Afolan F at 3.7 to 5 L/ha (1.32 to 1.78 qt/acre) in 220 to 330 L/ha (19.6 to 29.4 gal/acre) water or Lorox L at 3.4 to 4.5 L/ha (1.21 to 1.60 qt/acre) in 300 L (26.7 gal/acre) water. Treatment may be repeated after last cutting.

Amitrol-T (200 g/L, 2.00 lb/gal) Controls perennial grasses and thistles. (Table 1) Apply 22 L/ha (8.04 qt/acre) in 200 to 500 L/ha (17.8 to 44.5 gal/acre) water after last cutting.

Basfapon (74%), Dalapon (74%), Dowpon (74%), Dowpon M (74%) Controls barnyard grass, green and yellow foxtail. Apply Basfapon or Dalapon at 3.25 to 6.75 kg/ha (2.90 to 6.02 ib/acre) product in 200 L/ha (17.8 gal/acre) water or Dowpon or Dowpon M at 3.4 to 6.8 kg/ha (3.03 to 6.07 lb/acre) product. Apply after cutting before grasses are at the four leaf stage.

To control quackgrass in established asparagus apply Dalapon, Dowpon or Dowpon M at 11 kg/ha (9.81 lb/acre) product before cutting and again about three to four weeks later as needed. For a single treatment apply Dalapon at 22.5 kg/ha (20.07 lb/acre) product or Dowpon or Dowpon M at 22 kg/ha (19.63 lb/acre) product before or after the cutting season.

Apply Basfapon at 14.5 to 22.5 kg/ha (12.9 to 20.1 lb/acre) in 200 to 400 L/ha (17.8 to 35.6 gal/acre) water after cutting at one week before close of the cutting season, or in October after fern removal. Disc the field after last cutting. Do not make more than one application of Basfapon per season.

Gramoxone (200 g/L, 2.00 lb/gal) Controls annual grasses, broadleaf weeds and top growth of perennial weeds. Apply 2.75 to 5.5 L/ha (0.98 to 1.96 qt/acre) in 300 to 1100 L/ha (26.7 to 97.9 gal/acre) clean water to emerged weeds. Use the higher rate when weeds are above 5 cm (2 inches) in height, and the higher volume of water on dense weed growth. Do not apply to emerged spears which are to be used for human consumption.

Lorox L see Afolan F above.

Princep Nine-T (90%), Simadex (500 g/L, 5.00 lb/gal), Simadex 80 W (80%) Controls barnyard grass, wild oats and several broadleaf weeds. (Table 1) Apply Princep Nine-T at 2.5 to 3.75 kg/ha (2.23 to 3.35 lb/acre) product in 300 L/ha (26.7 gal/acre) water, Simadex at 4.5 to 6.7 L/ha (1.60 to 2.39 qt/acre) in 300 L/ha (26.7 gal/acre) water or Simadex 80 W at 2.75 to 4.25 kg/ha (2.45 to 3.79 lb/acre) product in 350 L/ha (31.2 gal/acre) water after discing in spring prior to weed and spear emergence and at least seven days before first cutting. A second application may be made after harvest completion if weeds are removed. Do not apply during cutting season.

2,4-D amine Controls perennial thistles. Apply 2.25 L/ha (0.80 qt./A) of formulations containing 500 g/L (5.0 lbs/gal.) 2,4-D in 100 L (8.9 gal/A) water. Product volumes of other 2,4-D formulations are given on Table 10 in the 1983 Guide to Chemical Weed Control. Apply after last cutting.

Disease Control

Rust Grow resistant varieties, Mary Washington has a good level of resistance. If rust has been severe in previous year apply one of the following: Zineb (Dithane Z-78) or metiram (Polyram 80W) at 2.2 to 3.4 kg/ha (2.00 to 3.00 lb/acre) to fern growth prior to appearance of disease. Do not apply zineb or mitiram to spears that are to be harvested.

Irrigation

Apply 2.5 cm (1 inch) water every 10 days during harvest if an equal amount of rain is not received. To develop healthy, vigorous roots for the following year's crops apply 5 cm (2 inches) water after harvest and 2.5 cm (1 inch) water toward the end of the growing season.

Disposal of Fern

To trap snow retain asparagus fern all winter. This protects the crowns from low temperature winter injury. The fern can be cut up with a rotary or flail-type mower before light discing in early spring. Use minimum cultivation for fern disposal and weed control.

Harvest and Storage

Asparagus may be harvested on a limited scale in the third year following seeding or in the second year after planting one year old crowns. The number of cuttings can be gradually increased and extended to the later part of June by the fourth year. The spears are cut 12 mm (one-half inch) below the soil with a sharp knife when they are 12 to 20 cm (5 to 8 inches) long.

Fresh harvested asparagus is very perishable and loses quality rapidly. Collect the spears as soon as possible, protecting them from the sun, and move to cold storage or market as soon as possible. If short term storage is necessary, store under high humidity (95%) at 1° to 2°C.

A well tended asparagus bed should be productive for 12 to 15 years.

Beans (Snap)

Varieties

Green Podded Tendercrop; Bush Blue Lake; Provider; Green pak.

Wax Podded Kinghorn; Gold Rush; Round Pod Kidney Wax; Top Notch Golden Wax.

Seed Treatment

Treat seed with a combination of lindane-diazinon and captan or thiram for protection against wireworms, seed maggots and seed-borne diseases. Ready prepared seed dressings are available from the trade and should be used according to manufacturer's directions.

Seeding

Place seeds about 3.8 to 5 cm (1-½ to 2 in) deep. Space rows 60 to 96 cm (24 to 38 inches) apart according to equipment available. Space plants 30 cm (six to eight per/foot) of row. Use 67 to 90 kg/ha (60 to 80 lb/acre) seed. Beans germinate best between 15° to 29°C.

Fertilizer

Beans are legumes and so enjoy an association with nitrifying bacteria which convert nitrogen from the soil air into a form the bean plant can use. These bacteria are available as pea and bean inoculants, from garden centres and seed companies. If an area has never grown beans or peas before, additions of inoculants are recommended. Heavy applications of manure or fertilizers high in nitrogen may induce a large amount of vine or leaf growth but frequently delay pod maturity and yield.

As a general application, apply 56 kg/ha (50 lb) N and 56 to 122 kg/ha (50 to 100 lb/acre) P_2O_5. Broadcast or sideband 5 cm (2 inches) to the side and 5 cm (2 inches) below seed. Banding of phosphorus is particularly desirable. The amount of nitrogen required will be less in soils where beans have been grown before and there are sufficient soil organisms established that will fix more nitrogen in the soil.

Irrigation

Moisture requirements are most critical from the bud stage to harvest. The crop requires 2.5 to 3.8 cm (1 to 1-½ inches)/week during this period for maximum yields.

Weed Control

Stale Seedbed

Refer to Stale Seedbed Weed Control on page 14.

Preplant Incorporated

Eptam 8-E 800 g/L (8.00 lb/gal), Eptam 10G (10%) Snap beans only. Controls annual grasses and several broadleaf weeds. (Table 1) Spring application only. Apply 4.25 to 5.5 L/ha (1.51 to 1.96 qt/acre) or 34 to 45 kg/ha (30.3 to 40.2 lb/acre) product. Apply liquid in at least 100 L/ha (8.9 gal/acre) water. The granular product should be applied with a suitable granular applicator. Eptam must be applied to a dry soil surface of a well prepared seedbed. Incorporate immediately according to instructions on product label or 1983 Guide to Chemical Weed Control.

Treflan EC (545 g/L, 5.45 lb/gal.) Controls green and yellow foxtail, wild oats and several broadleaf weeds (Table 1). For snap beans apply 1.5 to 2.0 L/ha (0.53 to 0.72 qt/acre) as a spring preplant application in at least 100 L/ha (8.9 gal/acre) water. For lima beans apply 1.0 to 1.5 L/ha (0.36 to 0.53 qt/acre). See product label or 1983 Guide to Chemical Weed Control for specific application instructions.

Treflan EC (400 g/L, 4.00 lb/gal) Controls green and yellow foxtail, wild oats and several broadleaf weeds. (Table 1) Spring application only. Apply 2 to 2.75 L/ha (0.71 to 0.98 qt/acre) in at least 100 L (8.9 gal/acre) water. See product label or 1983 Guide to Chemical Weed Control for specific application instructions.

Preemergence

Premerge 360 (360 g/L, 3.6 lb/gal), Sinox PE (360 g/L, 3.6 lb/gal), Yellow Stuff PE (360 g/L, 3.6 lb/gal) Controls several broadleaf weeds. (Table 1) Apply Premerge 360 or Sinox PE at 17 to 22 L/ha (6.05 to 7.83 qt/acre) in 250 to 400 L/ha (22.3 to 35.6 gal/acre) water at time of or shortly after planting. Apply Yellow Stuff PE on snap beans only, at 14 L/ha (5 qt/acre) in 400 to 500 L/ha (35.6 to 44.5 gal/acre) water. Do not apply these products on light sandy soil containing little or no organic matter.

Caution: Use rubber gloves, goggles, and agricultural respirator when handling Premerge 360, Sinox PE or Yellow Stuff PE.

Sinox PE see Premerge 360.
Yellow Stuff see Premerge 360.

Postemergence

Basagran (480 g/L, 4.8 lb/gal) Controls several annual broadleaf weeds. (Table 1). Apply 1.75 to 2.25 L/ha (0.62 to 0.80 qt/acre) in 200 to 400 L/ha (17.8 to 35.6 gal/acre) water after first trifoliate leaf stage. The addition of Citowett Plus at 2.5 L/1000 L (1 qt/100 gal) of spray mixture or Assist Oil Concentrate at 5 to 10 L/1000 L (2 to 4 qt/100 gal) of spray mixture will improve weed control.

Control Canada thistle and field bindweed with split application of 1.75 L/ha (0.62 qt/acre) plus 1.75 L/ha (0.62 qt/acre) applied seven to ten days later in 200 to 400 L/ha (17.8 to 35.6 gal/acre) water. For Canada thistle control only, add Citowett Plus at 2.5 L/1000 litres (1 qt/100 gal.) of spray mixture or Assist Oil Concentrate at 5 to 10 L/1000 litres (2 to 4 qt./100 gal) of spray mixture when thistles are in bud stage, 15 to 20 centimetres (6 to 8 in.) tall. Apply when field bindweed has developed a dark green colour and before it has begun trailing.

Premerge 360 (360 g/L, 3.6 lb/gal), Sinox PE (260 g/L, 3.6 lb/gal) Yellow Stuff PE (360 g/L, 3.6 lb/gal) Controls several broadleaf weeds. (Table 1) Apply Premerge 360 and Sinox PE at 8 to 14 L/ha (2.85 to 5.00 qt/acre) in 250 to 400 L/ha (22.3 to 35.6 gal/acre) water when beans are in, but not beyond the crook stage. Apply Yellow Stuff PE on snap beans only, at 8.5 L/ha (3.03 qt/acre) in 400 to 500 L/ha (35.6 to 44.5 gal/acre) water. Do not use these products on light sandy soil containing little or no organic matter.

Apply when crop foliage is dry. Leaf burn may occur, but this is usually not harmful. Spraying is more effective and less product is required at moderately high temperatures of 21° to 30°C (70° to 86°F). However to avoid crop damage, do not spray when temperatures exceed 30°C (86°F) or is expected to exceed 30° (86°F)

within 24 hours after application. Below 21°C (70°F) use the higher rates. Since these products act by contact action only, ensure that the spraying system gives uniform coverage of all weed foliage.

Caution Use rubber gloves, goggles, and agricultural respirator when handling Premerge 360, Sinox PE or Yellow Stuff PE.

Sinox PE see Premerge 360.
Yellow Stuff PE see Premerge 360.

Disease Control

Anthracnose and Bacterial Blights These casual organisms overwinter in seed and plant debris.

To control:

- use only disease free seed grown in an area free from these two diseases,
- practice a three year crop rotation, and
- do not work in crop when it is wet,
- apply tribasic copper sulphate (Tri cop) or cupric hydroxide (Kocide 101) at 1.1 to 3.3 kg/ha (1.00 to 3.00 lb/acre) at first sign of disease. Do not apply within one day of harvest. Chemical control may not be practical except for small seed plots or other special situations.

White Mold (Sclerotinia), Gray Mold (Botrytis) Apply benomyl (Benlate) at 1.75-2.25 kg/ha (26-34 oz/acre) or thiophanate methyl (Easout 70WP) at 1.6-2.25 kg/ha (24-34 oz/acre) at early bloom and repeat at full bloom. If only one application is to be made, apply 2.25 kg/ha (34 oz/acre) at full bloom. Chlorothalonil (Bravo 500) 4.8 L/ha (72 oz/acre). One application only at early bloom 15-25% or 3.2 L/ha (48 oz/acre) at early bloom and repeat in 5 days or at 75-80% bloom. Do not apply any of these chemicals within 14 days of harvest. Avoid dense foliage by restricting nitrogen.

Crop Rotation Three years between bean crops. Avoid other susceptible crops such as carrots, lettuce, parsnips, cucurbits, crucifers and sunflowers. Rotate with non-susceptible crops such as beets, onions, corn and cereals.

Fusarium and Other Soil-Borne Root Rots Treat seed with captan or thiram seed protectants. Avoid poorly drained soil and practice a crop rotation of at least three years.

Insect Control

Seed Maggots, Wireworms and Seed Decay Treat with a combination of diazinon, lindane and thiram or captan.

Leaf Hoppers 1) apply Sevin 80S at 2.2 kg/ha (2.00 lb/acre); 2) or apply Thiodan 4E at 2.1 L/ha (30 fluid ounces/acre); 3) or apply malathion 50EC at 2.2 L/ha (32 fluid ounces/acre).

Beets (Red)

Varieties

Round Early wonder (bunching); King Red; Ruby Queen; Detroit Dark Red; Vermilion; Spring Red.

Cylindrical Formanova.

Seed Treatment

Seed should be treated with thiram or captan before seeding. Apply according to manufacturer's directions.

Transplants

For early beets, sow seed in greenhouse six weeks prior to planting in the field. Seedlings should be placed approximately 7.6 cm (3 inches) apart in rows 30 to 40 cm (12 to 16 inches) apart when transplanted in the field. Care should be taken not to break the tap root.

Seeding

Sowing at two week intervals will provide a continuous supply for summer markets. Beets for storage should be sown about 10 weeks before normal harvest date.

Optimum germination temperature is 4° to 29°C. Seed should be placed 1 to 2 cm (one half to three quarter inch) deep. About 3 kg (6.00 lb) seed will plant an acre when seeded in rows 40 cm (16 inches) apart. Thin plants 5 to 8 cm (2 to 3 inches) apart.

Fertilizer

As a general recommendation, apply 84 kg/ha (75 lb/acre) nitrogen and 112 kg/ha (100 lb/acre) phosphorus. If crop is grown in lighter soil types, 56 to 112 kg/ha (50 to 100 lb/acre) potash should be added. The fertilizer may be broadcast and cultivated in, or sidedressed 5 cm (2 inches) to the side and 5 cm (2 inches) below the seed.

Trace Elements To prevent internal black spots, apply 22 kg/ha (20 lb/acre) borax along with the fertilizer or spray with a foliar spray at 4.4 kg/ha (4.00 lb/acre).

Weed Control

Stale Seedbeed

Refer to Stale Seedbed Weed Control on page 14.

Preplant Incorporated

Ro-Neet 7.2 E (720 g/L, 7.2 lb/gal) Controls annual grasses and several broadleaf weeds. (Table 1) Apply 4.75 to 6.25 L/ha (1.69 to 2.23 qt/acre) in 200 to 400 L/ha (17.8 to 35.6 gal/acre) water. Immediately after application, thoroughly incorporate to a depth of 5 to 7 cm (2 to 3 inches) taking care to minimize loss of seedbed moisture.

Preemergence

NaTa TCA (85%) Controls green and yellow foxtail. Apply 6.16 to 9.86 kg/ha (5.50 to 8.80 lb/acre) product in 100 L/ha (8.9 gal/acre) water before emergence. Do not feed tops to livestock.

Insect Control

Leaf Miners Generally, control required only for bunching beets. Spray with malathion 50 EC at 2.2 L/ha (32 fluid ounces/acre) when egg masses are noticed on the underside of the leaves, or spray with diazinon 50 EC at 3.4 L/ha (48 fluid ounces/acre).

Tarnished Plant Bug Spray with dimethoate 2E at 1.4 L/ha (20 fluid ounces/acre).

Storage

Roots should be stored at 0°C and relative humidity of 95%. Tap root should not be removed.

Cabbage, Cauliflower, Brussels Sprouts, Broccoli

Varieties

Cabbage

Early Golden Acre, Golden Cross Vela, Little Marvel, Tastie, Princess, Synargreen

Mid Season Market Topper, Market Prize, Jet Pack, Stonehead, Little Rock, Market Victor, Blue Heaven

Late: Summer Danish Ballhead, Autumn Marvel
Winter Tripple Green, Houston, Evergreen, Decema Extra, Winter White III, Excel.

Red Red Acre

Chinese Michilli

Cauliflower

Early Snowball Imperial, Snowcap, Snow Crown

Mid Season Imperial 10-6, Snowball M, Snowball 25

Late Snowball Y, Suprimax

Brussels Sprouts

Jade Cross, Jade Cross E, Lancelot, Alcazar, Goldmine

Broccoli

Premium Crop, Kayak, Surfer, Southern Comet, Green Comet, Cruiser.

Seed Treatment

Treat Seed with thiram or captan before seeding and apply according to manufacturer's directions.

Seeding

About 280 g/ha (4 ounces/acre) seed provides sufficient transplants for the land. For direct seeding, use 2.2 kg/ha (2.00 lb/acre) and thin to the desired population. Direct seeded crops should be sown 12 to 19 mm (one half to three quarter inch) deep.

Spacing

Cabbage

Early crop transplants are set in the field in early May. Late cabbage is seeded directly about a week later (May 10 to 15).

Early Rows 76 cm (2-½ feet) apart, plants 38 to 45 cm (15 to 18 inches).

Mid Season Rows 76 to 90 cm (2-½ to 3 feet) apart, plants 38 to 45 cm (15 to 18 inches).

Late Rows 76 to 90 cm (2-½ to 3 feet) apart, plants 45 to 60 cm (18 to 24 inches).

Cauliflower

Normally set out into the field as transplants after the danger of frost is over. Mid season and late crops are direct seeded.

Rows 76 cm (2-½ feet) apart, plants 45 to 60 cm (18 to 24 inches).

Brussels Sprouts

Grown only from transplants which are set out into field about May 20-25 and require the entire season to mature.

Rows 90 cm (3 feet) apart, plant spacing 53 cm (21 inches).

Broccoli

Grown from transplants or seed. Early crops are set out as transplants, while late crops are direct seeded.

Rows 60 cm (2 feet) apart, plants 10 to 15 cm (4 to 6 inches).

Fertilizer

Apply 112 kg/ha N (100 lb/acre) and 112 kg/ha (100 lb/acre) P_2O_5 as a broadcast or sideband treatment. Refer to **General Fertility Recommendation** for recommendations for potassium and sulphur.

Transplants As cole crops respond favourably to liberal application of nitrogen and phosphorus, use of a starter solution such as 20-20-20 is recommended. Mix at the rate of 454 g/45 L (1 lb/10 gal) of water and apply 284 mL (10 ounces) per plant.

Note: *If necessary, additional nitrogen at the rate of 28 to 39 kg/ha (25 to 35 lbs/acre) may be applied between the rows or applied through the irrigation system about a month after seeding or transplanting.*

Boron If the soils are known to be deficient in boron, apply 22 kg/ha (20 lb/acre) borax. It may be broadcast over the field and disced in before planting. If a foliar spray is used during the growing season, reduce the rate to 4.5 kg/ha (4.00 lb/acre) borax.

Weed Control

Stale Seedbed

Refer to Stale Seedbed Weed Control on page 14.

Preplant Incorporated

Treflan EC (545 g/L, 5.45 lb./gal.) Controls green and yellow foxtails, wild oats and several broadleaf weeds (Table 1). Spring application only. Apply 1.5 to 2.0 L/ha (0.53 to 0.72 qts/acre) water. See product label or 1983 Guide to Chemical Weed Control for specific application instructions.

Treflan EC (400 g/L, 4.00 lb/gal) Controls green and yellow foxtail, wild oats and several broadleaf weeds. (Table 1) Spring application only. Apply 2 to 2.75 L/ha (0.71 to 0.98 qt/acre) in at least 100 L/ha (8.9 gal/acre) water. See product label or 1983 Guide to Chemical Weed Control for specific application instructions.

Disease Control

Clubroot is an occasional problem in Manitoba but may become more frequent in occurrence if crop rotation is not followed. Follow a four year crop rotation and avoid all cruciferous crops including canola (rapeseed) and mustard in the same rotation. Thoroughly clean all planting and harvesting equipment between fields. Use a pressurized washer and follow with a disinfectant.

Damping Off, Wirestem Delay planting as long as possible to avoid cold, moist soils which favor disease development. Grow transplants in fumigated soil. Space seedlings in seed beds to allow air circulation around the plants. Dust seed with captan or thiram before planting.

Downy Mildew Brocolli and cauliflower heads. Avoid overwatering particularly in the late afternoon. Apply Bravo 500 at 2.5-4.8 L/ha (38-72 oz/acre) on a 7-10 day schedule. Do not apply within 7 days of harvest. Incorporate crop remains as soon as harvest is complete, to ensure early breakdown of crop residue.

Bacterial Soft Rot and Watery Soft Rot (Sclerotinia) Avoid injury to plants in cultivation or at harvest; use plant spacing that allows for good air circulation; control root maggots, slugs and other chewing insects. Disinfect storage bin with two per cent copper sulphate solution or other disinfectant before storing the crop. Follow a three year crop rotation and avoid other crucifers, beans, lettuce, carrots and celery. Rotate with cereals, corn, onions, beets.

Blackleg, Black Rot Sow hot water treated seed 50°C for 25 minutes for cabbage and brussels sprouts and 15 minutes for cauliflower or broccoli. Avoid working in field when plants are wet. Follow a three year crop rotation.

Brown Heart (Boron Deficiency) See fertilizer.

Insect Control

Root Maggots Apply Birlane granules at 550 grams/300 m (20 ounces/1000 ft) row or apply Dasanit granules at 1,160 grams/1000 m (13.3 ounces/1000 feet) row. Work granules into top 2.5 cm (1 inch) soil in 15 cm (6 inches) band and seed into band.

Cabbage Worm, Cabbage Looper, Diamond-Back Moth Larvae Spray with diazinon 50EC at 1.1 L/ha (16 fluid ounces/acre); Monitor at 1.1 to 2.4 kg/ha (16 to 33 fluid ounces/acre); Lannate L at 1.25 to 2.5 L/ha (17 to 33 fluid ounces); Thiodan 4E at 1.4 to 2.8 L/ha (20 to 40 fluid ounces/acre); Belmark at 160 to 330 mL/ha (2.3 to 4.7 fluid ounces/acre); Ambush 70-140 mL/ha (1 to 2 fluid ounces/acre), or with Bacillus thuringiensis according to label directions. Dust with rotenone at 22 kg/ha (20 lbs/acre) 1 per cent dust.

For use on broccoli and cabbage only, apply Decis 2.5 EC at 0.3 to 0.4 L/ha (4.2 to 5.6 fl. oz./A) in 350 to 550 L/ha (30.8 to 48.4 gal/A) water when insects are present or signs of insect feeding are visible. Repeat every 10 days or as necessary. Do not treat within 7 days of harvest. Do not apply to high organic (muck) soils.

Aphids Spray with either Malathion 50EC at 1.1. to 2.8 L/ha (16 to 40 fluid ounces/acre), or Thiodan 4E at 2.1 L/ha (30 fluid ounces/acre), or Dimethoate (Cygon 4E, Rogor 40) at 0.7 to 1.4 L/ha (10 to 20 fluid ounces/acre), or Monitor at 1.1 to 2.3 L/ha (16 to 33 fluid ounces/acre), Ambush at 75 to 150 mL/ha (1.2 to 2.3 fl. oz/acre).

Flea Beetles Watch carefully for flea beetles as small plants emerge from the soil. Spray plants every five to seven days until plants become well established. Use Malathion 50EC at 1.1 L/ha (16 fluid ounces/acre) or Thiodan 4E at 1.5 to 3.0 L/ha (20 to 40 fluid ounces/acre) or Sevin 80S at 0.7 to 1.5 kg/ha (10 to 20 oz/acre).

Slugs See slugs under Celery and refer to General Pesticide Recommendations section.

Special Problems

Cabbage Splitting Well developed heads may split if heavy rains follow a prolonged dry spell. The splitting is caused by rapid growth promoted by improved growing conditions. Maintaining uniform growth with proper irrigation may partially prevent this.

Cauliflower Buttoning This is identified by the formation of a small head before the plant is mature enough to support it. It causes the head to remain small and unmarketable. It may be the result of:

1. Overhardening of the young plants.
2. Unbalanced soil fertility.
3. Too low moisture supply.
4. Extreme and cold weather 4° to 10°C for 10 days or more especially under conditions of excess soil moisture.

An application of 45.5 kg/ha (100 lb./acre) of 34-0-0 through the irrigation system may assist in rectifying the problem. Application should be made as soon as possible after stress conditions occur.

Harvest and Storage

Cabbage and Brussel Sprouts Cabbage heads are harvested after the heads have become firm. Brussel Sprouts are harvested when sprouts are 2.5 to 5 cm (1 to

2 inches) diameter. Sprouts are best stored on the stock for longer storage life. Sprout development is improved and made more uniform by pinching the growing point of the plants when the middle sprouts are about 12 to 19 mm (one half to three quarters inch) in diameter. Both crops store well at a temperature of 0°C and a relative humidity of 100 per cent. To retain the rich green color, field heat must be removed immediately after entering storage. Most green coloring will disappear unless the temperature is reduced within the first week of storage.

Cauliflower Harvest heads when they are 15 cm (6 inches) or more in diameter and before the curd begins to separate and "rice". Tying up the leaves to enclose the head is usually necessary to produce a bright white curd.

Broccoli Heads should be harvested when the flower bud clusters are well formed but before yellow flowers appear. The terminal bud is the largest and forms first, followed by the laterals. Broccoli should be trimmed to about 15 cm (6 inches).

Cauliflower and broccoli will store for short periods of time if the field heat is removed immediately after harvest. For broccoli, storage quality is maintained at a much higher level if the product is covered with a layer of crushed ice (slush) after it is packed in the container ready for shipment. This helps prevent dehydration while it is moving through the distributive trade.

Carrots

Varieties

Fresh Market Six Pak, Hipack (main crop), Sierra, Figaro, Flakkeese Flacoro.

Processing Sparton Bonus, All Season Cross, Royal Cross

Seeding

Seedbed Preparation Deep fall plowing 20 to 35 cm (8 to 10 inches) followed by spring operation that will leave a fine seedbed for uniform germination. Prepare land in three to four row beds to prevent compacted tire tracks in growing area.

Rates Optimum stand of carrots is 10 to 16 carrots per 30 cm (foot) of row. This is usually obtained in Nantes types by using hole 7 or 8 on Plant Jr. seeder. Increase seeding rate slightly for Imperator types. The ground speed of seeder will affect seeding rate if Plantet Jr. seeder is used.

Row Spacing 40 to 50 cm (16 to 20 inches)

Depth 2 to 2.5 cm (three quarter to one inch) is most satisfactory. Since the seed is very small at no time should it be planted more than 2.5 cm (1 inch) deep.

Dates	Early crop	May 10 to 15
	Storage crop	May 24 to 31

Irrigation

The carrot is not tolerant to drought or high temperatures. It needs steady and relatively large amounts of water for optimum growth. If high temperature conditions exist when seedlings are just emerging, irrigation will prevent serious damage to the young plants. Irrigation can be used very effectively to overcome heavy soil crusting that can reduce the stand if not removed.

Fertilizer

Carrots have shown little response to chemical fertilizer in Manitoba except when grown on relatively light soils low in nutrients. Where soil fertility is low (according to soil tests) apply 10-30-10 at 224 kg/ha (200 lb/acre) as a sideband treatment. An additional 39 kg/ha (35 lb/acre) of nitrogen may be added during the growing season if heavy stand is obtained.

Weed Control

Stale Seedbed

Refer to Stale Seedbed Weed Control on page 14.

Preplant Incorporated

Treflan EC (545 g/L, 5.45 lb/gal) Controls green and yellow foxtail, wild oats and several broadleaf weeds (Table 1.) Spring application only. Apply 1.5 to 2 L/ha (0.53 to 0.72 qt/acre) in at least 100 L/ha (8.9 gal/acre) water. See product label or 1983 Guide to Chemical Weed Control for incorporation instructions.

Treflan EC (400 g/L, 4.00 lb/gal) Controls green and yellow foxtail, wild oats and several broadleaf weeds. (Table 1) Spring application only. Apply 2 to 2.75 L/ha (0.71 to 0.98 qt/acre) in at least 100L/ha (8.9 gal/acre) water. See product label or 1983 Guide to Chemical Weed Control for incorporation instructions.

Postemergence

Afolan F (450 g/L, 4.5 lb/gal), Lorox L (480 g/L, 4.8 lb/gal) Controls barnyard grass, green and yellow foxtail and several broadleaf weeds. (Table 1) Apply Afolan F at 1.9 to 5L/ha (0.68 to 1.78 qt/acre) or Lorox L at 2.25 to 4.5 L/ha (0.80 to 1.60 qt/acre) in 220 to 330 L/ha (19.6 to 29.4 gal/acre) water.

Do not apply with greater than 275 kPa (40 psi) pressure. Spray when carrots have two or more fully developed leaves. Use lower rates on small seedling weeds and higher rates on larger established weeds. Apply before annual grasses exceed 5 cm (2 inches) in height or before broadleaf weeds exceed 15 cm (6 inches). During hot, dry weather spray in the cool part of the day to avoid injury.

Agricultural Weedkiller No. 1 (100%) Controls barnyard grass and several broadleaf weeds. (Table 1) Apply 600 to 900 L/ha (53.4 to 71.2 gal/acre) as an overall treatment when carrots are in the two to four leaf stage and before weeds are 10 cm (4 inches) tall. **Spray in evening when humidity is high and winds are light.**

Caution: Do not mix Agricultural Weedkiller No. 1 with other herbicides.

1. If Afolan F or Lorox L is applied first, wait 24 hours before applying Agricultural Weedkiller No. 1

2. If Agricultural Weedkiller No. 1 is applied first, wait at least two weeks before applying Afolan F or Lorox L.

Hoe Grass (190 g/L, 1.9 lb/gal) Controls certain annual grasses (Table 1). Apply 5.3 L/ha (75.8 fluid ounces/acre) product in at least 112.3 L/ha (10 gal/acre) water when weeds are in one to four leaf stage. Consult label for correct application procedure.

Lorox L see Afolan F

Disease Control

Aster Yellows Control leafhoppers that spread the mycoplasma (see insect control). Avoid growing carrots near forage legumes or other areas where leafhopper populations are high.

Leaf Spots and Blights Spray every 7 to 14 days depending on weather condition with one of the following fungicides: maneb (Manzate D, Dithane M-33) 3.4 kg/ha (3.00 lb/acre); mancozeb (Dithane M-45, Manzate 200) 2.2 kg/ha (2.00 lb/acre); metiram (Polyram 80W) 2.2 kg/ha (2.00 lb/acre); zineb (Dithane Z-78) 3.4 kg/ha (3.00 lb/acre); chlorothalonil *(Bravo 500) 1.6-2.4 L/ha (24-36 oz/acre)*. Refer to page 8 "Residue Tolerances and Days to Harvest.

Bacterial Soft Rot and Watery Soft Rot (Sclerotinia)
Handle the crop carefully to avoid wounds. Cull during harvest if rots are present. Disinfect storage area before storage using a 2 per cent solution of copper sulphate (for example, 1 kg/50 L water or 2.00 lb/10 gallons water). Allow storage area to dry before storing carrots. Follow a crop rotation of two years between successive crops. Avoid beans, lettuce, parsnips, cole crops including canola (rapeseed), peas, lentils, cucumber and celery since all are susceptible to Sclerotinia. Rotate with onions, beets, cereals or corn. Spray or dip washed or unwashed carrots either before or after storage period with Benomyl (Benlate 50WP) at *.5-1.0 kg/1000 L* (1/2 to 1 lb/100 gallons) of water. Do not treat carrots for export with Benlate 50 WP.

Insect Control

Leafhoppers Apply Sevin XLR at 1.25 to 2.5 L/ha (18 to 36 fluid ounces/acre) or malathion 50 EC at 2.2 L/ha (32 fluid ounces/acre) twice weekly or Furadan 10G at 22.4 kg/ha (20 lb/acre) at planting time. Apply in seed furrow 1.3 cm (one half inch) below the seed. Additional sprays late in July and during August of other insecticides (Sevin, malathion) are required for maximum control.

Special Problems

Greening Constant hilling throughout the growing season is essential to prevent green shouldered carrots.

Off-Shape Roots These may be caused by:

- lack of stand
- poorly prepared seedbed
- excess moisture at certain periods
- excessive packing of soil by equipment

Browning Caused mainly from excessive drying of roots following harvest such as:

- harvesting in excessive heat
- neglecting to remove carrots from field immediately after harvest
- lack of cooling facilities in storage
- excessive drying in storage through lack of humidity controls

Preventive Measures

- Harvest under cool conditions when possible.
- Prevent drying from field to storage.
- Remove field heat rapidly after carrots have entered storage.
- Maintain humidity of storage at 100 per cent and temperature at 0°C.
- Soaking pile periodically after carrots are in storage helps prevent drying and aids in removing field heat. However, this practice may favor development of Sclerotinia soft rot in stored carrots.

Celery

Varieties

Utah 52-70

Seed Treatment

Purchase hot water treated seed or use three year old seed to avoid seed-borne blight disease. Treat seed with a fungicide such as thiram (according to directions on label) before planting in flats. Seed germination is normally slow and often takes up to 20 days from seeding.

Transplants

Allow 10 to 12 weeks to produce plants for field planting. As a rule of thumb, 210 g of seed produces sufficient transplants for 1 hectare (3 ounces for 1 acre). The general practice has been to plant celery at 30 x 30 cm (12 x 12 inch) spacing.

A starter solution such as 20-20-20 is recommended. Mix 454 g (1.00 lb) fertilizer/45 L (10 gal) water and apply 280 to 300 mL (one-half pint) per plant.

Temperatures of 21° to 24°C are quite suitable for germination. The regular growing temperature should be held at 18° to 21°C. If plants are subjected to temperatures of 2° to 10°C "bolting to seed" occurs. The amount of bolting increases as the exposure period is lengthened. Thus, plants should not be set in the field until the danger of a prolonged cool period is over, and may be hardened if desired by withholding water the last 7 to 10 days before setting in the field. Do not harden off

plants by lowering the temperature. Clip the tops once or twice while the plants are in the flats to develop sturdier seedlings.

Fertilizer

For optimum yields of celery, apply 224 kg/ha (200 lb/acre) of nitrogen and 112 kg/ha (100 lb/acre) of P_2O_5 as a sideband application at planting time. If fertilizer is broadcast and worked in prior to seeding increase the rate of P_2O_5 by 25 per cent. If cracked stems have been a problem, boron should be added as borax at 17 kg/ha (15 lb/acre). If spraying borax over the crop, reduce the rate to 4.5 kg/ha (4.00 lb/acre). Refer to ***General Fertility Recommendations on page 12 for application of potassium and sulphur.***

Weed Control

Postemergent to weeds, 8 to 10 days after transplanting and new growth has started.

Afolan F (450 g/L, 4.5 lb/gal.) Controls barnyard grass, green and yellow foxtail and several broadleaf weeds. (Table 1) Apply 1.9 to 5 L/ha (0.68 to 1.78 qt/acre) in 220 to 330 L/ha (19.6 to 29.4 gal/acre) water. Do not apply under hot conditions.

Disease Control

Early and Late Blight Use disease free seed or seed more than two years old or seed that has been hot water treated at 48°C for 30 minutes. Follow a regular spray program commencing about July 15. Apply sprays every 7 to 10 days unless there is a prolonged period of dry weather. Fungicides found effective against blight include Chlorothalonil *(Bravo 500) at 2.4 to 4.0 L/ha (36 to 60 oz/acre)* (do not apply within seven days of harvest).

Anilazine (Dyrene 50 WP) at 2.25 to 3.5 kg/ha (2 to 3 lb/acre). Wash and trim before packing if last application was made less than seven days before harvest. Refer to page 8. "Residue Tolerances and Days to Harvest."

This disease can become very severe under wet conditions late in the season.

Black Heart (Physiological) Maintain uniform soil moisture in the field. Avoid excess application of fertilizer. Apply calcium nitrate at 11 to 22 kg/ha (10 to 20 lb per acre) or calcium chloride at 5.6 to 11 kg/ha (5.00 to 10 lb/acre) in 454.6 L (100 gal.) water every 7 to 10 days during periods when disease threatens, especially during cloudy warm weather.

Aster Yellows Control the leafhopper which spreads the mycoplasma. Refer to the Insect Control Section. Avoid growing celery near forage legumes or other areas where leafhopper populations are high.

Insect Control

Leafhoppers Spray or dust every seven days with Sevin 80S at 1.4 L/ha (20 fl. oz. acre) or malathion 50 EC at 2.2 L/ha (32 fl. oz./acre).

Tarnished Plant Bug Spray or dust with Thiodan 4E at 2.1 L/ha (30 fluid ounces/acre).

Aphids Spray with malathion 50 EC when required at 1.4 L/ha (20 fluid ounces) or thiodan 4E at 2.1 L/ha (30 fluid ounces/acre).

Slugs Apply a directed spray of metaldehyde between the plant rows early in June. Repeat as required. Do not apply spray to edible portions of plants. Do not spray within 14 days of harvest.

Metaldehyde may also be purchased in the granular form. This material may be applied as a band between the rows. Apply according to directions on the label. Refer to ***General Pesticide Recommendations*** on page 11.

Harvest and Storage

Celery is cut 2.5 to 5.0 cm (1 to 2 inches) below the crown. Trim the coarse outer leaves. Prior to storage, the field heat should be removed through hydro-cooling. Celery will last up to two months in storage with a minimum of loss if held at 0°C and a relative humidity of 95 per cent.

Corn (Sweet)

Varieties

Early Earlivee, Dawn, Beacon, Early Arctic, Northlite, Queen Anne

Main Crop Table Vee, Golden Beauty, Yukon, NK 51036, Golden Vee, Sunny Vee, Ont. Hyb. 8011 and 814, Jubilee

Late NK199, Honeycomb, Flavorvee, Sugar Loaf, Candy Bar, Bullseye, Golden Nectar

White Snowcap, White Lightning, Stardust

Seeding

Soil temperature should be above 13°C for rapid and vigorous germination.

Date May 15 approximately

Rate 11 to 13 kg/ha (10 to 12 lb/acre)

Spacing Rows 76 to 95 cm (30 to 42 inches) apart (depending on machinery for cultivation). Plants 20 to 25 cm (8 to 10 inches) apart in the row for early varieties and 25 to 32 cm (10 to 12 inches) for main crop varieties.

Fertilizer

Application should be based on recommendations provided from soil sample analyses submitted to the Manitoba Soil Testing Laboratory.

Corn is usually planted on previously cropped land and responds well to additions of nitrogen and phosphorus. All phosphate and potash where required should be sidebanded at seeding time. Nitrogen may be sidebanded

when mixtures of nitrogen-phosphate-potash or nitrogen-phosphate are used, for example, 8-24-24 or 27-14-0 etc. The total amount of fertilizer material sidebanded should not exceed 340 kg/ha (304 lb/acre). Nitrogen requirements not sidebanded at time of seeding should be sidedressed before the corn is 15 cm (6 inches) high.

Where application based on a soil test is not feasible, the general recommendations listed in the table below may improve yields (actual nutrients listed).

Excess nutrient levels may occur when high rates of fertilizer are used on continuous corn. Soil testing to a depth of 60 cm (24 inches) is strongly recommended to monitor nutrient levels and avoid over-fertilization.

To determine the possible cause of poor growth due to nutrient deficiencies, refer to pages 20 and 21 of the publication "Field Corn in Manitoba". Contact your local agricultural representative.

RATE OF NUTRIENT TO ADD

	Nitrogen (N)(1)		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
Corn to be grown on	**kg/ha**	**lbs/acre**	**kg/ha**	**lbs/acre**	**kg/ha**	**lbs/acre**	**kg/ha**	**lbs/acre**
Fallow or legume breaking (2)	10-50	9-45	30-45	27-40	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	30-75	27-67	30-45	27-40	(3)	(3)	(4)	(4)
Stubble	75-145	67-129	30-45	27-40	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See Page 11.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 30 to 110 kg/ha, (27 to 98 lb/acre) of potash (K_2O).

(4) Twenty kg/ha (18 lb/acre) of sulphur (S) are recommended on well-drained sandy soils. For information on the application of different forms of sulphur fertilizer see Page 12.

Weed Control

Stale Seedbed

Refer to Stale Seedbed Weed Control on page 14.

Preplant Incorporated

Dual (960 g/L, 9.6 lb./gal) Controls green and yellow foxtail and barnyard grass. Apply 2 to 2.75 L/ha (0.71 to 0.98 qt/acre) in a minimum of 150 L/ha (13.4 gal/acre) water. Use higher rate for heavy weed infestations. Incorporate in the top 5 cm (2 inches) of soil with a tandem disc, vibrating shank cultivator or harrows set to work the soil no deeper than 10 cm (4 inches). Immediate incorporation is not required. Do not use on peat or muck soils. Heavy rainfall conditions following application of Dual may result in reduced weed control, especially on sandier soil types. Dual may be tank mixed with Aatrex or Atrazine. See product label or 1983 Guide to Chemical Weed Control for incorporation instructions.

Eradicane 8-E (800 g/L, 8.00 lb/gal) Controls several grasses and broadleaf weeds. (Table 1) Earlivee, Golden Beauty, Golden Jubilee, M-71112, M-71276, NK 51036, NK 199, North Star, Reliance (NK 2580), Span Cross, Sunnyvee and Yukon are tolerant varieties. Apply at 4.25 to 5.5 L/ha (1.51 to 1.96 qt/acre) in at least 100 L/ha (8.9 gal/acre) water to the dry soil surface of a well prepared seedbed. Spray and incorporate immediately. Plant seed to a maximum depth of 5 cm (2 inches). See product label or 1983 Guide to Chemical Weed Control for information on incorporation and rates required.

Lasso (480 g/L, 4.9 lbs/gal) Controls green and yellow foxtail. Apply 7.5 to 9.5 L/ha (2.7 to 3.38 qt/acre) in a minimum of 150 L/ha (13.4 gal/acre) of water. Incorporate in the top 5 cm (2 inches) of soil with a tandem disc working at 7.5 to 10 cm (3 to 4 inches) followed by a harrow. Do not use on peat or muck soils. Lasso may be tank mixed with Atrazine. See product label or 1983 Guide to Chemical Weed Control for information on incorporation or rates required.

Primextra (500 g/L, 5.00 lb/gal) Controls green and yellow foxtail, barnyard grass and several broadleaf weeds. (Table 1) Apply 6.7 to 8.5 L/ha (2.39 to 3.03 qt/acre) in a minimum of 150 L/ha (13.4 gal/acre) water. Use the higher rate when heavy weed infestations are expected. Incorporate thoroughly into the top 5 cm (2 inches) of soil prior to planting. Immediate incorporation is not necessary. Heavy rainfall conditions following application of Primextra may result in reduced weed control, especially on sandier soil types. See product label or 1983 Guide to Chemical Weed Control for incorporation instructions. This treatment may leave a residue in the soil the following year. See caution under Sutan+ and Atrazine.

Sutan+ (800 g/L, 8.00 lb/gal) Controls green and yellow foxtail and barnyard grass. Apply 4.25 to 5.5 L/ha (1.51 to 1.96 qt/acre) in a minimum of 100 L/ha (8.9 gal/acre) water to a dry soil surface of a well prepared seedbed. Spray and incorporate immediately. Do not seed deeper than 5 cm (2 inches). See product label or 1983 Guide to Chemical Weed Control for incorporation instructions. Follow Sutan+ application with a recommended postemergence herbicide to control broadleaf weeds if necessary.

Sutan+ (800 gL, 8.00 lb/gal) and Atrazine Controls barnyard grass, green and yellow foxtail, wild oats and several broadleaf weeds. (Table 1) Apply 4.25 to

5.5 L/ha (1.51 to 1.96 qt/A) Sutan+ with 2.4 to 3.5 L/ha (0.86 to 1.25 qt/A) liquid atrazine (500 g/L, 5.0 lb/gal) or equivalent amounts of other formulations of atrazine. For product volumes of various atrazine formulations refer to 1983 Guide to Chemical Weed Control, Table 9. Apply in 100 to 500 L/ha (8.9 to 44.5 gal/acre) water to a dry soil surface of a well prepared seedbed. Spray and incorporate immediately. Plant seed to a maximum depth of 5 cm (2 inches). See product label or 1983 Guide to Chemical Weed Control for incorporation instructions.

Caution: Atrazine or Primextra may remain as a residue in the soil the following year. Flax, peas and fababeans are more tolerant crops and should be considered to follow corn.

Postemergence

For corn less than 15 cm (6 inches) tall (leaf outstretched) the following treatments may be applied as an overall spray.

Basagran (480 g/L, 4.8 lb/gal) Controls several broadleaf weeds. (Table 1) Apply 1.75 to 2 L/ha (0.62 to 0.80 qt/acre) in 200 to 400 L/ha (17.8 to 35.6 gal/acre) water. Use the lower rate to control lady's thumb and annual smartweed species 2.5 to 7.5 cm (1 to 3 inches) high, wild mustard 2.5 to 12.5 cm (1 to 5 inches) high or cocklebur 7.5 to 17.5 cm (3 to 7 inches) high. Use the higher rate to control lady's thumb and annual smartweed species 7.5 to 20 cm (3 to 8 inches) high, wild mustard 12.5 to 25 cm (5 to 10 inches) high, cocklebur 17.5 to 30 cm (7 to 12 inches) high, and seedlings of other susceptible weeds. The addition of Citowett Plus at 2.5 L/1000 litres (1 qt./100 gal.) of spray mixture or Assist Oil Concentrate at 5 to 10 litres/1000 litres (2 to 4 qt./100 gal.) of spray mixture will improve the control of advanced weeds.

Basagran also controls top growth of Canada thistle and field bindweed (patch treatment). Apply a split application of 1.75 L/ha (0.62 qt/acre) plus 1.75 L/ha (0.62 qt/acre) seven to ten days later. Apply in 200 to 400 L/ha (17.8 to 35.6 gal/acre) water, when thistles are in the bud stage, 15 to 20 cm (6 to 8 inches) tall and when field bindweed has developed a dark green color and before it has begun trailing. Add Citowett Plus at 2.5 L/1000 litres (1 qt/100 gal) spray mixture or Assist Oil Concentrate at 5 to 10 L/1000 litres (2 to 4 qt/100 gal) of spray mixture to improve control. Best results are obtained when Basagran is applied under higher temperatures 21°C (70°F).

Kil-mor (500 g/L, 5.00 lb/gal) Controls several broadleaf weeds. (Table 1) Apply 0.85 to 1.1 L/ha (0.30 to 0.39 qt/acre) in 100 L/ha (8.9 gal/acre) water as an overall spray. For corn over 15 cm (6 inches) tall see postemergence recommendation in this section.

2,4-D amine Controls several broadleaf weeds (Table 1). Apply 840 to 1120 mL/ha (0.30 to 0.40 qt./A) of formulations containing 500 g/L (5.0 lb/gal) 2,4-D amine in 100 L (8.9 gal/A) water as an overall spray until corn is 15 cm (6 inches) tall (leaf outstretched), after which a directed spray should be used. See directed post emergence recommendations in this section for product volumes of other formulations of 2,4-D amine or see Table 10 in the 1983 Guide to Chemical Weed Control.

Yellow Stuff PE (360 g/L, 3.6 lb/gal) Controls several weeds. (Table 1) Apply 8.5 L/ha (3.03 qt/acre) in 400 to 500 L/ha (35.6 to 44.5 gal/acre) water after emergence from the spike stage until corn is 7.5 to 10 cm (3 to 4 inches) high. Severe burning will result if temperature is over 29°C (84°F) or when corn has developed beyond the two leaf stage.

Caution: Use rubber gloves, goggles and agricultural respirator when handling Yellow Stuff PE.

For corn over 15 cm (6 inches) tall the following treatments may be applied as an overall spray.

Pardner (225 g/L, 2.25 lb/gal) Controls several broadleaf weeds. (Table 1). Apply 1.25 to 1.5 L/ha (0.45 to 0.53 qt/A) in at least 200 L/ha (17.8 gal/A) water. Apply when corn is in the four to eight leaf stage and before the weeds are past the four leaf stage. Do not use under conditions of high humidity and high temperature (greater than 30°C or 86°F) or crop injury may occur.

Torch (227 g/L, 2.27 lb/gal) Controls several broadleaf weeds. (Table 1) Apply 1.25 to 1.75 L/ha (0.45 to 0.62 qt/acre) in at least 159 L/ha (14.2 gal/acre) water. Apply before weeds are past the four leaf stage and before corn is 25 cm (10 inches) high. Do not apply under conditions of high humidity and high temperature (greater than 30°C or 86°F) or crop injury may occur.

Directed Postemergence

For corn over 15 cm (6 inches) tall (leaf outstretched). Application of these herbicides requires positioning of the nozzles to direct spray to the base of the corn plant. Severe damage is likely if the crop leaves are sprayed.

Kil-mor (500 g/L, 5 lb/gal) Controls several broadleaf weeds. (Table 1). Apply 0.85 to 1.1 L/ha (0.30 to 0.39 qt/acre) in a minimum of 100 L/ha (8.9 gal/acre) water.

2,4-D amine Controls several broadleaf weeds (Table 1). Apply 1.7 L/ha (0.60 qt/A) of formulations containing 500 g/L (5.0 lbs/gal) 2,4-D amine in 100 to 200 L/ha (8.9 to 17.8 gal/A) water according to the species and stage of weeds present. For product volumes of other formulations of 2,4-D amine see Table 10 in the 1983 Guide to Chemical Weed Control.

Insect Control

European Corn Borer Apply two or more sprays at seven day intervals beginning approximately July 15. Spray with Carbaryl (Sevin 80S) at 2.8 kg/ha (2.5 lb/acre) or Lannate L at 2.6 L/ha (37 fluid ounces/acre) or Furadan 4.8F at 1.1 L/ha (16 fluid ounces/acre) or Ambush 500 EC at 200 to 275 mL/ha (2.9 to 3.9 fluid ounces).

Corn Earworm Spray with Carbaryl (Sevin) at 2.8 kg/ha (2.5 lb/acre) or Lannate L at 2.6 L/ha (37 fluid ounces/acre) or Furadan 4.8F at 1.1 L/ha (16 fluid ounces/acre) or Thiodan 50 WP at 2.2 to 3.4 kg/ha (2 to 3 lb/acre) or Ambush 500 EC at 200 to 275 mL/ha (2.9 to 3.9 fluid ounces/acre).

Bee Warning

Bees often visit sweet and field corn to collect pollen. While spraying is being done bee poisoning may result.

Sevin, Furadan and Ambush are highly toxic to bees but Sevin is the most damaging since it is carried to the hive and poisons the brood.

If bees are in the area advise local beekeepers of spraying activity and do not use Sevin. Your local Agricultural representative has a list of beekeepers in your area.

Bee poisoning is reduced when sprays are applied in early morning or late evening when bees are not foraging. Do not treat when the wind is blowing. Avoid spray drift to roadsides and adjacent fields where plants may be in bloom.

Disease Control

Treat seed with Captan 75 or Thiram 75 seed protectants.

Leaf Blights, Stalk Rots and Ear Rots In crop rotation, allow three years before replanting field to corn; rotate with crops other than cereals and grasses. Maintain balanced soil fertility and avoid high nitrogen imbalance.

Smut To prevent spread of smut cut off and destroy smut balls before they open. Crop rotation.

Harvesting and Storage

Sweet Corn is harvested when the kernel is fully formed but still tender. Most varieties reach this stage about the time the silk turns brown or approximately three weeks after the silks first appear. Until familiar with outward signs, test for readiness by pressing the tip kernels with your fingernail. The milky contents of the kernel should spurt out when pressure is applied.

Harvested corn must be cooled rapidly and held at below 5° C and at high humidity or it will lose quality very quickly. After harvest, sweet corn should be marketed in the shortest possible time.

Cucumbers (Fresh), Squash, Pumpkin

Varieties

Cucumbers

Pickling: Green Spear 14, Perfecto Verde, Alouette, Carolina

Slicing: Burpeeana Hybrid; Ashley, Burpee's Hybrid, Saticoy Hybrid, Marketmore, Burpless Hybrid, Victory

Bread & Butter: Japanese Long; China

Squash

Summer Squash: Green zucchini types — Diplomat, Zucchini, Zucchini Select, Black Jack.

Yellow Straightneck types — Goldbar, Goldzini, Gold Rush.

Scallop types — St. Pat Scallop.

Marrow types — Vegetable Marrow.

Winter Squash: Acorn types — Table acorn

Buttercup types — Buttercup

Butternut types — Waltham Butternut

Hubbard types — Baby Hubbard

Other Winter Squash — Vegetable Spaghetti

Pumpkin

Jack O'Lantern, Funny Face, Cinderella, Big Max, Spirit

Seed Treatment

Apply captan or thiram to the seed according to manufacturer's instructions.

Seeding

Vine crops are all frost tender thriving only if weather is warm. Delay seeding and transplanting until late May and early June when soil temperatures are 16° C or higher. Cucumbers, pumpkins and squash may be raised either from transplants, for early crops, or from direct seeding in the field. About 2.2 kg/ha (2 lb/acre) of seed is required to produce enough transplants for one hectare.

For direct seeding of cucumbers 4.5 to 5.5 kg/ha (4 to 5 lb/acre) are required. Squash and pumpkin seeding rates vary somewhat with seed size. Large-seeded cultivars will require 1 to 1.5 kg/ha (1 to 1-1/2 lb/acre).

Suggested spacing requirements:

Cucumbers

Rows 1.2 to 1.8 m (4 to 6 feet), plants 30 to 38 cm (12 to 15 inches) apart.

Pumpkin (Standard) and Winter Squash

Rows 1.8 to 2.5 m (6 to 8 feet), plants 90 to 120 cm (3 to 4 feet) apart.

Pumpkin (Bush) and Summer Squash

Rows 90 to 120 cm (3 to 4 feet), plants 60 to 90 cm (2 to 3 feet) apart.

Sow cucumbers at a depth of 1.3 to 2.5 (1/2 to 1 inch) and squash/pumpkin at 2.5 cm (1 inch).

Fertilizer

When using transplants, the application of a starter fertilizer such as 10-52-17 or 10-40-10 is recommended. Mix at a rate of 454 g (1 lb) fertilizer/45 L (10 gal) water and apply 284 to 300 mL (one-half pint) per plant. *Always base fertilizer application on the results of an annual soil test.*

Cucumbers

Apply 84 kg/ha (75 lb/acre) nitrogen, 56 kg/ha (50 lb/acre) phosphate and 56 kg/ha (50 lb/acre) potassium as a sideband application at seeding time. The fertilizer band should be at least 5 cm (2 inches) to the side and 5 cm (2 inches) deeper than the seed.

Squash and Pumpkin

Apply nitrogen at 56 to 67 kg/ha (50 to 60 lb/acre) and phosphate (P_2O_5) at 134 kg/ha (120 lb/acre) prior to seeding. Sidedress with 84 to 112 kg/ha (75 to 100 lb/acre) nitrogen when plants start to run.

Irrigation

Good moisture is necessary throughout growing season. Irrigate to supply 2.5 cm (1 inch) water after seeding or transplanting. Good moisture reserves are also necessary at time of flowering and fruit development *Do not let soil dry out during this period.* Avoid irrigation while bees are working the field by irrigating in the late afternoon or evening.

Pollination

All vine crops depend on insects to transfer pollen from male to female blossoms. These are borne separately on the same plant. To ensure adequate pollination introduce one colony of honeybees for every 2 to 3 acres.

Weed Control

Cucumbers

Stale Seedbed

Refer to Stale Seedbed Weed Control on page 14.

Preplant Incorporated

Prefar (480 g/L, 4.8 lb/gal) Controls barnyard grass, green and yellow foxtail. Apply 12 to 14 L/ha (4.27 to 5.00 qt/acre) in 100 to 500 L/ha (8.9 to 44.5 gal/acre) water. Incorporate 2.5 to 5 cm (1 to 2 inches). See caution regarding residue under Prefar plus Alanap 3 recommendation.

Prefar (480 g/L, 4.8 lb/gal) plus Alanap 3 (240 g/L, 2.4 lb/gal) Controls barnyard grass, green and yellow foxtail and several broadleaf weeds. (Table 1) Apply 9.5 to 14 L/ha (3.38 to 5.00 qt/acre) Prefar plus 9.5 to 19 L/ha (3.38 to 6.77 qt/acre) Alanap 3. Apply as a tank mix in 100 to 400 L/ha (8.9 to 35.6 gal/acre) water. Incorporate lightly 1 to 3 cm (0.4 to 1.2 inches). Use lower rate on light sandy soils.

Caution: Do not apply Prefar more often than once every 12 months. To avoid crop injury rotate only to cucumbers, peppers, cole crops, carrots, lettuce or tomatoes.

Preemergence

Dyanap (330 g/L, 3.3 lb/gal) Controls barnyard grass, green and yellow foxtail and several broadleaf weeds. (Table 1) Apply 14 to 17 L/ha (5.00 to 6.05 qt/acre) in 200 to 400 L/ha (17.8 to 35.6 gal/acre) water. Thorough and uniform coverage of the surface is essential for good weed control. If soil is cold at time of seeding delay Dyanap application until soil temperature warms up. Do not apply after crop has emerged.

Squash and Pumpkins

Carry out between row cultivation prior to vining. Avoid damage to root systems by using shallow cultivation and keeping a good distance from roots. Hand hoe within row.

Insect Control

Cucumber Beetles Spray or dust when plants are breaking through, and at weekly intervals with rotenone or Thiodan 4E at 1.4 L/ha (20 fluid ounces/acre) or Guthion SC at 2.3 L/ha (33.5 fluid ounces/acre).

Aphids Spray with malathion 50 EC at 2.2 L/ha (32 fluid ounces/acre) or Thiodan 4E at 1.4 L/ha (20 fluid ounces/acre) when required.

Apply insecticides in the evening when bees are not working fields. If hives are in crop, cover them when treating field.

Disease Control

Angular Leaf Spot (Cucumbers) Follow a three year crop rotation. Apply one of the following: fixed copper (Tri-cop, Neutro-cop, Basi-cop, Kocide 101) at 3.4 kg/ha (3 lb/acre) if disease appears. Destroy vines after harvest. See page 9 for fungicide pre-harvest waiting period.

Bacterial Wilt (Cucumber, Pumpkins, Squash) Control the cucumber beetles which transmit the disease (see cucumber beetles).

Seed Decay and Damping Off (Cucumbers, Pumpkins, Squash) Treat seed (if not already treated by seed company) with one of captan, thiram or dexon seed treatment fungicides.

Powdery Mildew and Scab (Cucumbers, Pumpkins, Squash) Use disease free seed and apply one of these fungicides: benomyl (Benlate 50W) at 0.6 to 1 kg/ha *(8-10 oz/acre)*, or chlorothalonil *(Bravo 500) at 3.2 to 4.8 L/ha (48-72 oz/acre)* applied every 7 to 10 days. See Table 3 for fungicide pre-harvest waiting period.

Storage

Cucumbers and summer squash should be stored at 7° to 10°C and 95 per cent relative humidity. A storage life of 7 to 10 days can be expected. Cucumbers and summer squash are sensitive to chilling injury at temperatures below 7°C. Avoiding moisture loss is important.

Pumpkins and winter squash store best at 7° to 10°C and 70 to 75 per cent relative humidity. These crops should be cured for two weeks at 25° to 30°C to aid the healing of minor injuries. After curing, temperatures should be reduced to the 7° to 10°C range. Storage life of pumpkins and squash depends largely on their type and variety.

Cucumbers (Processing/ Mechanical Harvest)

Varieties

Greenspear 14, Peto-Triple Mech, Target, Carolina.

Seed Treatment

Apply captan or thiram to the seed according to manufacturer's instructions.

Seeding

Cucumber seeds do not germinate at a soil temperature below 10°C and germinate slowly at 20°C. Fastest germination occurs at 25° to 30°C. Delay sowing until the soil temperature is 15°C or higher. Seeding can continue to about July 10-12. Sowing crops later than July

12 increases the possibility of frost damage in the fall. Good germination and uniform emergence and growth for once-over mechanically-harvested crops is important.

A precision seeder helps to ensure uniform crop emergence and development. Never plant cucumber seed deeper than 2.5 cm (1 inch).

For once-over harvest, present cucumber harvestors efficiently harvest up to 300,000 plants/ha (120,000 plants/acre). With irrigation, populations of 150,000 to 200,000 plants/ha (60,000 to 80,000 plants/acre) are recommended. 4.5 to 8 kg/ha (four to seven lb/acre) seed is required.

To obtain 200,000 plants/ha (80,000 plants/acre), plant 4 row beds with 2.1 m (7 feet) centres to accommodate the harvestor cutter bar, with 50 cm (20 inches) between rows and 60 cm (24 inches) alleyways every 4 rows.

Fertilizer

Make applications on the basis of recommendations developed from soil test analysis from the Manitoba Soil Testing Laboratory.

Nitrogen For soils containing less than 2 per cent organic matter, 45 to 56 kg N/ha (40 to 50 lb N/acre) is recommended. On soils with greater than 2 per cent organic matter, 28 to 45 kg N/ha (25 to 40 lb N/acre) is adequate. On sandy soils where leaching occurs, apply nitrogen fertilizer close to the time of uptake by the plants to prevent leaching. On these soils, apply one-half of the nitrogen close to planting and the remainder as the vines begin to fill the rows. On loamy soils, where leaching is not a problem, 28 to 45 kg N/ha (25 to 40 lb N/acre) may be broadcast and disced in before planting or side-dressed at the second or third true leaf. If nitrogen is applied through an irrigation system, no more than 11 kg N/ha (10 lb N/acre) per application should be used.

Phosphate (P_2O_5) Requirements for high population cucumber crops are 28 to 45 kg/ha (25 to 40 lb/acre). Increasing soil test phosphate levels above 224 kg P/ha (200 lb P/acre) is not advised. Here, high levels may induce zinc deficiency where soil zinc levels are marginal. Phosphate can be broadcast in prior to planting.

Potash (K_2O) Requirements are 112 to 157 kg/ha (100 to 140 lb/acre). Building the soil test potassium level to above 392 kg K/ha (350 lb K/acre) is not recommended. Prior to planting, broadcast and disc potassium fertilizer.

Irrigation

The irrigation system should supply 1 to 2 acre-inches of water per week. Do not allow leaves to wilt while plants are growing. Cucumber water needs are particularly sensitive during the fruit set and development period. When scheduling irrigation, consider foliage disease development and interference with honeybee pollination activity. Minimize the time the foliage is wet to help avoid disease infestation. Schedule irrigation when bees are inactive to improve pollination.

Pollination

Cucumber pollination is accomplished by bees, particularly honeybees. Colonies should be moved into or alongside the field. One colony per 50,000 plants should ensure adequate pollination. Place the colonies in the field about five days after bloom starts, so that flowering will be sufficient to attract bees to the field. If bees are introduced into the field too early, they may become excessively "locked in" to other plants in the area.

Weed Control

Chemical Weed Control

See Cucumbers (Fresh)

Cultural Weed Control

Where row spacing allows cultivation, cucumbers may be cultivated until the two to four leaf stage with a minimal amount of damage. Rolling cultivators or finger weeders which stir only the top inch of soil are preferred. Deeper cultivation can cause serious root injury or expose many new weed seeds.

Insect Control

See Cucumbers (Fresh)

Disease Control

See Cucumbers (Fresh)

Harvesting and Storage

Once-over mechanical harvesting is a very timely operation. A rapid fruit-weight change, and a significant change in the value of the crop can occur over a 24-hour period. Profits are maximized only if harvesting is carried out when cucumbers have the grade distribution required to maximize returns.

To best determine optimum harvest time, walk the field and collect the fruit from 0.9 m^2 (10 square feet) sample areas. Generally, harvesting should begin when about 10 per cent of the fruit have reached 4 to 5 cm (1.6 to 2.0 inches) diameter. Observe the crop frequently as it approaches readiness for harvest. Processors usually dictate the grade distribution they prefer, so harvesting can be adjusted accordingly.

Harvested cucumbers should be processed or stored in brine solution immediately. If fresh cumcumbers need to be held for a short period of time before processing or placing in brine tanks, they should be cooled as rapidly as possible to 7° to 10°C. Hydrocooling has been successful in removing field heat. Hold cucumbers at 7° to 10°C under 90 to 95 per cent relative humidity for no longer than 7 to 10 days. They should be processed immediately after removal from storage. Storage temperatures lower than 7° to 10°C will result in chilling injury, especially if removed from storage and held at high temperature before use.

Harvestor information can be obtained from:

Province of Manitoba
Manitoba Agriculture
Soils and Crops Horticulture Section
908 Norquay Building
Winnipeg, Manitoba R3C 0V8
OR
Manitoba Agriculture
Soils and Crops Vegetable Specialist
25 Tupper Street North
Portage la Prairie, Manitoba R1N 3K1

Eggplant

Varieties

Black Magic, Black Bountiful

Seed Treatment

Use hot water-treated seed and dust with thiram seed protectant before planting. Apply 1 teaspoon/lb seed.

Transplants

Eggplants are a long season crop and must be started indoors. Seed is sown 8 to 10 weeks before field planting. Seeds germinate best at 26° to 29°C in sterilized soil. Care should be taken not to chill plants at any stage of development. About 280 g of seed produces transplants for 1 hectare (4 ounces for 1 acre).

Spacing Set plants 45 to 60 cm (1 ½ to 2 feet) apart in rows 81 to 91 cm (2½ to 3 feet) apart.

Irrigation

Eggplants are a rank growing crop needing ample moisture at all times.

Fertilizer

Apply 56 kg/ha (50 lb/acre) N and 112 kg/ha (100 lb/acre) phosphorus either broadcast or sidebanded, at planting time. See peppers for use of starter solution.

Weed Control

Use shallow cultivation. There are no recommended chemicals for eggplant.

Disease Control

Damping-Off Treat seed (if not already treated) with captan or thiram seed treatment.

Early Blight Use one of the following: maneb (Dithane M-22, Manzate D) 3.3 kg/ha (3 lb/acre), or zineb (Dithane Z-78) 3.3 kg/ha (3 lb/acre). Apply when first fruit clusters are well formed. Repeat at intervals of 7 to 10 days. Apply more frequently if weather is favorable to disease development. See page 9 for pre-harvest waiting period.

Verticillium Wilt Follow crop rotation of three to four years between successive crops of eggplants. Avoid tomatoes, peppers, sunflowers, alfalfa, sweet clover and potatoes which are also susceptible.

Insect Control

Flea Beetles Spray Thiodan at 1.4 L/ha (20 fluid ounces/acre) or Sevin 80S at 1.4 kg/ha (1.25 lb/acre).

Aphids Spray malathion 50EC at 1.1 to 3 L/ha (16 to 40 fluid ounces/acre) or Thiodan 4E at 1.4 L/ha (20 fluid ounces/acre).

Colorado Potato Beetle Spray Sevin 80S at 700 g/ha (10 ounces/acre).

Harvesting and Storage

Fruit may be harvested at any time after reaching a sufficient size. It should be taken from the plant before the flesh becomes tough and the seeds begin to harden. The fruit is generally harvested when half grown, and used in its immature stage. Eggplant is subject to chilling if stored at temperatures below 4°C. Optimum temperatures for storage are 7° to 10°C.

Lettuce

Varieties

Leaf — Slobolt, Grand Rapids, Salad Bowl, Prizehead

Crisphead or Iceberg — Ithaca, Salinas, Highland

Butterhead — Buttercrunch, Summer Bibb

Romaine or Cos — Parris Island, Valmaine

Plant Characteristics

Lettuce is a cool weather crop and produces best at 15° to 18°C. Best results have been obtained from the early transplant crop and the late crops grown from seed. Early May transplanting is recommended for the spring crop as plants, if properly conditioned, withstand temperatures as low as −6°C.

Planting

Transplants Start in a greenhouse 6 to 8 weeks before field planting: 280 g of seed produces sufficient transplants for 1 hectare (4 ounces for 1 acre) if sown thinly in flats. Transplant seedlings into flats at 5 cm (2 inch) spacings. Thoroughly soak flats with a starter solution of 10-52-17 before transplanting to the field.

Direct Seeding Leaf lettuce may be sown from the time the ground is ready in the spring until the latter part of August. Head lettuce of the Iceberg varieties require 8 to 10 weeks from seed and six weeks from plants. Rate of seeding is 1.6 kg to 2.2 kg/ha (1 ½ to 2 lb/per acre) seed.

Spacing Leaf and butterhead varieties 20 to 30 cm (8 to 12 inches) between plants, 30 cm (12 inches) between rows. Head lettuce 35 to 45 cm (14 to 18 inches) between plants and 40 cm (16 inches) between rows. Plants should be thinned when two or three leaves have formed.

Fertilizer

Apply 112 kg/ha (100 lb/acre) N and 112 kg/ha (100 lb/acre) P_2O_5 as a broadcast over the field before planting.

Additional application may be made through the irrigation system if required.

Weed Control

There are no recommended herbicides for lettuce.

Disease Control

Aster Yellows Destroy perennial weeds around the headlands early in spring. Spray or dust the crop with malathion 50EC at 2.2 L/ha (32 fluid ounces/acre) twice weekly beginning with emergence or transplanting to control leafhoppers which carry and transmit the disease; or apply Thimet (phorate) 10% G at 11.2 kg/ha (10 lb/A) in the fertilizer band in one or both sides of the row at seeding time, or when transplants are set in the field. Thimet is not effective for the entire crop period necessitating follow-up spray application. See label for cautions.

Physiological Breakdown Head lettuce breakdown occurs very frequently following warm rain as the crop is reaching maturity. Having the crop mature during the cooler part of the season helps prevent this condition.

Bacterial Slime Rot A bacterial rot often accompanies the physiological breakdown of lettuce heads. Avoid overcrowding and overwatering. Harvest promptly when mature and pre-cool to 10°C immediately.

Fungal Rots (Botrytis SP., Rhizoctonia Solani and Sclerotinia Sclerotiorum) Turn under crop refuse promptly after harvest. Avoid poorly drained fields and overcrowded planting. Discard heads with any trace of infection at harvest. Pre-cool to 1°C immediately after harvest. Follow a three year crop rotation avoiding beans, peas, carrots, cucumbers, squash, tomatoes and crucifers. For a list of field crops susceptible to sclerotinia disease see the *Field Crop Recommendations for Manitoba* published annually by Manitoba Agriculture.

Insect Control

Leaf Hoppers Spray or dust the crop with Malathion 50EC at 2.2 L/ha (32 fluid ounces/acre) or apply Thimet (phorate)-10%G at 11.2 kg/ha (10 lb/acre) in the fertilizer band on one or both sides of the row at seeding time, or when transplants are set in the field. See label for cautions.

Onions

Varieties

Transplants (Spanish Types) Riverside, Bullring, Valdez, Monarch, Ringmaker, Chiefton, Winner.

***Cooking* (seeded)** Autumn Spice, rocket, Garnet, Topaz, Bronze Age, Copper Cache, Canada Maple, Northern Oak.

Sets Ebenezer (yellow or white), Stuttgarter

Pickling Perla Prima, Aviv, Crystalwax

Bunching Pefecto Blanco, White Lisbon, He-Shi-Ko

Seeding

Date As early as land can be prepared.

Spacing Rows 35 to 45 cm (14 to 18 inches) apart depending on equipment for cultivation.

Seeding *Dry onions* 2.2 to 2.9 kg/ha (2 to 2½ lb/acre).

Pickling 22 to 28 kg/ha (20 to 25 lb/acre).

Sets 50 to 78 kg/ha (45 to 70 lb/acre).

Depth Plant seeds 1.3 to 1.9 cm (one-half to three-quarter inch) deep.

Fertilizer

Dry Onions Nitrogen 67 kg/ha (60 lb/acre) P_2O_5 112 kg/ha (100 lb/acre) Potash 67 kg/ha (60 lb/acre)

Sets and Pickling Onions apply:

67 kg/ha (60 lb/acre) nitrogen

112 kg/ha (100 lb/acre) P_2O_5

On loamy sands add 112 kg/ha (100 lb/acre) K_2O

Note: Apply fertilizer as a sideband application or broadcast. Burning will take place if applied directly with the seed.

Irrigation

All types of onions are very shallow rooted and quite susceptible to drought conditions. Any setback from lack of moisture may result in early maturity of bulbs with lack of size and therefore reduced yields. Maintaining satisfactory moisture level is essential for maximum yields.

Weed Control

Stale Seedbed

Refer to Stale Seedbed Weed Control on page 14.

Preemergence

CIPC (480 g/L, 4.8 lb/gal) plus Randox (480 g/L, 4.8 lb/gal) Controls barnyard grass, green and yellow foxtail and several broadleaf weeds. (Table 1) Apply 9.36 L/ha (3.33 qt/A) CIPC plus 9.5 L/ha (3.38 qt/A) Randox in 220 L (19.6 gal/A) water. Apply before weeds germinate and before onions have reached the loop stage. Rain or irrigation of at least 1.25 cm (0.5 inches) is required immediately after application for satisfactory results. Randox is recommended for use on soils high in organic matter or clay. It is less effective on sandy soils that are low in organic matter or clay.

Note: Registration of Randox may not be continued for 1983. Consult Manitoba Agriculture regarding availability and permit requirements.

Randox (480 g/L, 4.8 lb/gal) Controls barnyard grass, green and yellow foxtail and broadleaf weeds. (Table 1) Apply 14 L/ha (5.00 qt/A) immediately after planting or if heavy rain is expected just before crop emergence.

On sets or transplant onions, apply 14 L/ha (5.00 qt/A) as a directed spray (overall sprays may cause tip burn dur-

ing hot weather) soon after planting.

For a delayed or second application, apply 14 L/ha (5.00 qt/A) as a directed spray when the onions (except green onions) have developed three true leaves. Do not use within 45 days of harvest. Randox is recommended for use on soils high in organic matter or clay. It is less effective on sandy soils that are low in organic matter or clay.

Note: Registration of Randox may not be continued for 1983. Consult Manitoba Agriculture regarding availability and permit requirements.

Postemergence

Hoe Grass (190 g/L, 1.9 lb/gal) Controls certain annual grasses in **dry bulb onions only**. (Table 1) Apply 5.25 L/ha (1.87 qt/A) in at least 110 L/ha (9.8 gal/A) water at a nozzle pressure of 275 kPa (40 psi). Direct nozzles 45° forward. Apply when the weeds are in the one to four leaf stage, and before they tiller. Other postemergence herbicides must be applied at least four days after Hoe Grass application. Do not apply if rain is expected within one hour.

Totril (225 g/L, 2.25 lb/gal) Controls several broadleaf weeds. (Table 1) Apply 2 L/ha (0.71 qt/acre) in 400 L/ha (35.6 gal/acre) water. Apply when weeds are in the seedling stage and after the crop is in the three leaf stage. Applications may be repeated after 14 days for late emerging weeds.

Blast, Purple Blotch Apply anilazine (Dyrene 50W) at 2.2 kg/ha (2 lb/acre) when the disease is first noticed. Repeat at intervals of 7 to 10 days but do not apply within one day of harvest.

Storage Neck Rot Once the tops have been removed, dry rapidly with forced air at 35°C for the first week or two. The air temperature may then be reduced to 26°C until onions are well cured.

Disease Control

Smut Use the seed protectant fungicide, Pro-Gro (carbathiin and thiram) at 57 g/2.270 kg (2 ounces/5 lb) seed. First moisten seed with methocel sticker solution at 29 *mL* Methocel per 580 *mL* hot water (1 ounce/pint). Allow to stand overnight at room temperature. Add 29 *mL* of methocel solution to 454 grams (1 ounce/lb) onion seed. Mix thoroughly. Apply Captan 75 at 340 g/4.5 g (0.75 lb/ 10 lb) seed or Thiram 75 at 340 g per 4.5 kg (0.75 lb/10 lb) seed for control of seed rot.

Insect Control

Onion Maggots Either diazinon 5G at 280 to 460 g/300 m (10 to 20 ounces/1000 foot) row or Dasanit 15G at 7.5 kg/ha (6.6 lb/acre) or Lorsban 15G at 8 to 16 kg/ha (7.1 to 14.3 lb/acre) may be applied in the seed furrow at planting time. (Rates are for 40 cm (16 inches) row spacing).

Note:

- Avoid applying Dasanit to green bunch onions.
- Apply Lorsban 15G only with Pro-Gro treated seed. Use only on dry and pickling onions. Pre-harvest wait period when applied with dry onions is 141 days and with pickling onions is 97 days.

Onion Maggot Flies and Thrips Spray regularly with diazinon 50EC at 1.1 L/ha (16 fluid ounces/acre) as an overall spray when flies appear, usually shortly after seedlings emerge and during July. Thrips may severely infest a crop during period of high temperature and drought conditions. A white flecking of the onion top evident in early summer, may be an indicator of thrip infestation.

Note: Onions left in the field after harvest are a major source of over wintering onion maggot. This is especially true following early harvest of Dutch sets and pickling onions. Prevent all regrowth. Remove where possible, or plow under immediately after harvest.

Storage

If onions are dried in the field they should be well cured before placing in storage. Provide air circulation to keep them drying during storage. If onions are cured artificially, hold the forced air temperature at 35° C for the first and second week to kill neck rot organisms. For immature (greenish) slowly raise temperature to 32° C to avoid heat damage to the bulbs. Then reduce temperature to 26°C for the remainder of the curing process.

When well cured, gradually reduce the storage temperature on onions as close to 0°C as possible. For sprout inhibition, apply maleic hydrazide (MH amine) at 8.4 L/ha (6 pints/acre) in approximately (1123 L/ha (100 gal/acre) water when 50 per cent of the tops are down.

Constant storage temperature is more important than actual temperature. Onions have stored well at temperatures varying from 0° to 13°C. The selected temperature must be held constant throughout the storage period to prevent sprouting.

Parsnips

Varieties

Model, All America, Guernsey

Seeding

Seed Always use fresh seed. Avoid using seed more than two years old.

Rate 3.3 to 5.6 kg/ha (3 to 5 lb/acre)

Row Spacing 45 to 60 cm (18 to 24 inches)

Depth 1.3 to 2.5 cm (½ to 1 inch) depending on moisture conditions. Deep seeding reduces stand.

Thinning Thin seedlings 5 to 10 cm (2 to 4 inches) in row.

Cultural Practices

Recommended cultural practices for fertilizer, weed and insect control are identical as for carrots.

Weed Control

Postemergence

Afolan F (450 g/L, 4.5 lb/gal) Controls barnyard grass, green and yellow foxtail and several broadleaf weeds. (Table 1) Apply 1.9 to 5 L/ha (0.68 to 1.78 qt/acre) in 220 to 330 L/ha (19.6 to 29.4 gal/acre) water. Do not apply with greater than 275 kPa (40 psi) . Spray when parsnips have two or more fully developed leaves. Use lower rates on small seedling weeds and the higher rates on larger established weeds. Apply before annual grasses exceed 5 cm (2 inches) in height and before broadleaves exceed 15 cm (6 inches). During hot, dry weather spray in the cool part of the day to avoid injury.

Agricultural Weedkiller No. 1 (100%) Controls barnyard grass and several broadleaf weeds. (Table 1) Apply 600 to 800 L/ha (53.4 to 71.2 gal/acre) as an overall treatment when crop is in the two to four leaf stage and before weeds are 10 cm (4 inches) tall. Spray in evening when humidity is high and the winds are light.

Caution: Do not mix Agricultural Weedkiller No. 1 with other herbicides.

1. If Afolan F is applied, wait 24 hours before applying Agricultural Weedkiller No. 1.
2. If Agricultural Weedkiller No. 1 is applied first, wait at least two weeks before applying Afolan F.

Disease Control

Watery Soft Rot (Sclerotinia). Handle the crop carefully to avoid wounds. Cull during harvest if rots are present. Disinfect storage area before storage using 2% solutions of copper sulphate (for example, 1 kg/50L or 2 lbs/100 gals water). Allow storage area to dry before storing parsnips. Follow a crop rotation of two years between successive crops. Avoid beans, lettuce, carrots, cole crops, rapeseed, peas, lentils, cucumber and celery since all are susceptible to Sclerotinia. Rotate with onions, beets, cereals or corn.

Peppers

Varieties

Sweet

Belle Types: Lady Belle, California Wonder, Green Boy, Cadice Hybrid, Staddon's Select, Hybrid Golden Bell, Ace Hybrid, Big Bertha

Pimento or Spanish: Earlired, Dutch Treat, Vinedale.

Hot

Red Hot, Hungarian Yellow, Gold Spike, Early Jalapeno, Anaheim

Transplants

Since pepper seeds germinate slowly, start plants in the greenhouse 9 to 10 weeks before they are set outdoors: 205 g of seeds produces transplants for 1 hectare (3 ounces for 1 acre). A temperature of 26° to 29°C is required to produce good germination and continued vigorous plant growth.

Plant small seedlings into flats when the first true leaves begin to grow. 5 to 6 cm (2 to 2-1/2 inches) are required between plants.

Pepper plants require some hardening before being placed in the field. To do this reduce temperatures to 15 °C and cut down the water supply. This will give resistance to wilting.

Spacing Make rows 60 to 81 cm (2 to 2-1/2 feet) wide and allow 38 to 45 cm (15 to 18 inches) between transplants.

Fertilizer

The shock of transplanting can be reduced by applying a starter solution such as 10-52-17 when placing the plant in the field. Mix fertilizer at the rate of 454 g/45 L (1 lb to 10 gal) water and apply 284 *ml* (10 ounces) around the roots of each plant.

An overall application of 56 kg/ha (50 lb/acre) nitrogen and 112 kg/ha (100 lb/acre) phosphorus broadcast or sidebanded when planting will ensure a healthy vigorous crop. For potassium and sulphur requirements refer to *General Fertility Recommendations.*

Weed Control

Preplant Incorporated

Treflan EC (400 g/L, 4.00 lb/gal) Controls green and yellow foxtail, wild oats and several broadleaf weeds. (Table 1) Spring application only. Apply 2 to 2.75 L/ha (0.71 to 0.98 qt/acre) in at least 100 L/ha (8.9 gal/acre) water. See product label or 1983 Guide to Chemical Weed Control for incorporation and rates required.

Treflan EC (545 g/L, 5.45 lb/gal) Controls green and yellow foxtail, wild oats and several broadleaf weeds (Table 1). Spring application only Apply 1.5 to 2.0 litres/ha (0.53 to 0.72 qt/acre) in at least 100 L/ha (8.9 gal/acre) water. See product label or 1983 Guide to Chemical Weed Control for incorporation and rate recommendation.

Insect Control

Flea Beetles, Aphids, Tarnished Plant Bug Spray with malathion 50 EC at 2.2 L/ha (32 fluid ounces/acre) or Thiodan 4E at 1.4 L/ha (20 fluid ounces/acre) or spray with dimethoate (Cygon 4-E, Rogor 40) 1 to1.4 L/ha (15 to 20 fluid ounces/acre). Dimethoate is not effective on flea beetles.

Pepper Maggot At weekly intervals starting the last week of June, apply Thiodan 4E at 2.8 L/ha (40 fluid ounces/acre) or dimethoate (Cygon 4-E, Rogor 40) at 1 to 1.4 L/ha (15 to 20 fluid ounces/acre).

Note: Do not feed vegetables treated with Thiodan (Endosulfan) or Cygon and Rogor (Dimethoate) to poultry or livestock.

Disease Control

Damping-Off Grow seedlings in sterilized soil. Use Captan 50 WP after seeding. Apply 175 mL (5 tablespoons)/18 L (4 gal) water and drench flat. Repeat the application when the first true leaves appear. Apply sufficient spray to cover plants.

Wilt Verticillium wilt may be serious if crop rotation includes tomatoes, eggplant, sunflowers, alfalfa, sweet clover and potatoes. Follow a three to four year rotation with crops other than those mentioned.

Sunscald This may occur whenever fruit are excessively exposed to hot sun. A yellowish-white patch appears on the side of the fruit facing the sun. A blister-like area develops and which eventually becomes depressed, greyish-white with a dry paperlike surface.

Harvest

Peppers may be picked as soon as they reach marketable size. Remember they wilt quickly if too immature when picked. Sweet peppers are usually picked as green fruit. If they are left on the plant, they will turn red. Hot varieties should be left until they turn red.

Storage

Sweet peppers are stored only briefly, as they are not well adapted to long storage. Desirable temperatures are 7° to 10°C and relative humidity of 85 to 90 per cent Peppers are subject to chilling at temperatures below 7°C.

Potatoes

Varieties

Early Crop
Red — Norland
White — Warba

Storage Crop
Red — Norland, Red Pontiac
White — Norchip, Kennebec, Shepody
Russet — Russet Burbank

Variety Description

Warba An early maturing variety with pink eyed tubers which are rough, blocky and fairly deep eyed. It has good cooking quality and good yielding ability. Suitable for early harvest.

Norland A good yielding, early maturing variety with shallow eyes, oblong to round medium bright red skinned attractive tubers. Cooking quality is fair but subject to after cooking discoloration. This variety is used as "an out of the field chipper". Chipping quality out of storage is unsatisfactory. Norland tubers have a short dormancy period, are moderately resistant to scab and susceptible to seed piece decay. Insect damage and drought frequently reduce its marketable yield.

Norchip A white, smooth, medium maturing variety with attractive, high specific gravity tubers with good chipping characteristics. Plants tend to have a heavy set of tubers. Growers can compensate for this with wider spacing in the row. Dormancy period is very short and sprout inhibition must be early if storage treatment is used.

Kennebec A very late high yielding variety with thin smooth skinned, shallow eyed large tubers. It is suitable for chipping but difficult to store unless quality seed is planted. Care should be taken during harvest to prevent damage. Greening frequently is a serious problem.

Red Pontiac A high yielding, late maturing, drought tolerant variety with attractive red skinned medium deep eyed tubers. Dry matter content is low but tubers have a good white color after cooking. Following a period of dry weather, rain causes the tubers to enlarge rapidly predisposing them to skinning and shattering during harvest.

Russet Burbank A high quality, late maturing variety with russet skinned, shallow eyed tubers. It is particularly suitable for processing (other than chips) and baking. A consistent adequate supply of moisture is required for uniform tuber growth. Otherwise, very rough, knobby tubers will result. Hollow heart can be a severe problem.

Shepody A high quality, late mid-season maturing variety with large, white skinned, oblong to elliptical tubers. Yield, specific gravity and french fry color are similar to Russet Burbank. First harvest for processing is expected to be acceptable at a minimum of 10 to 14 days earlier than Russet Burbank.

IN ROW SPACING GUIDE WITH BETWEEN ROW SPACING OF 38 INCHES (96 cm) FOR DRYLAND PRODUCTION

VARIETY	Seed		Table Stock		Processing	
	In.	cm	In.	cm	In.	cm
Kennebec	9-10	23-25			10-12	25-30
Norchip	12-13	30-33			13-14	33-36
Norland	11-13	28-33	12-13	30-33		
Red Pontiac	10-11	25-28	10-11	25-28		
Russet Burbank	12-13	30-33	15-16	38-40	17-18	43-46
Shepody*	12-15	30-38			15-18	38-46
Warba	12-13	30-33	13-14	33-36		

*Spacing Guide is based on limited data and field experience.

Seed Handling Practises

The regular purchase of Foundation or Certified seed is an excellent practice to follow. Handling techniques are also important.

Tubers should be cut into blocky seed pieces, 40 to 55 g (1-½ to 2 ounces) in size. Separate and discard chips and slivers below 28 grams (1 oz.) This reduces the number of weak plants in the field and increases yield potential.

Seed potatoes should be hauled, stored and handled with equipment that is thoroughly cleaned and disinfected. Use high pressure washers or steam for cleaning and a quarternary ammonium compound in solution under pressure for disinfecting. Use a quaternary ammonia product such as HY X, Potato Gard or Teramine, and mix using 600 ml product per 160 L water (20 oz/35 gal water) or household bleach (5% solution) at 600 ml product per 4.5 L water (20 oz product/gal water).

Where practical, warm seed potatoes prior to cutting. This results in short, thick sprouts developing. While cutting potatoes, disinfect cutting and the handling machinery. If cut seed is not being planted immediately, very specific conditions for storage must be provided. These are:

- dust type of seed treatment
- forced air circulation through the pile
- holding temperature of around 16°C and relative humidity of 85 to 95 per cent for at least 3 days
- after the curing period, maintain humidity but reduce temperature. Reduce air flow by operating fans intermittently.

Seed Treatment

Proper treatment of cut seed, will help assure a good stand of plants in the field.

Dry Treatment Apply one of the following: metiram (Polyram), captan or mancozeb (Dithane M-45, Manzate 200) or thiophanate methyl (Easout) according to manufacturer's directions. Application mechanism should provide a uniform coverage of dust over the surface of the cut tubers.

Wet Treatment Less than six hours after cutting, dip pieces in captan 50 per cent or 75 per cent WP at 3 kg/1000 L (3 lb/100 gal water). Plant immediately or if necessary store in small open slatted crates or store under forced ventilation.

Planting Requirements

SEED REQUIREMENTS FOR 38 INCH BETWEEN ROW SPACING (CWT/A)

	In-Row Plant Spacing (Inches)					
Seed Set Weight (oz.)	**8**	**10**	**12**	**14**	**16**	**18**
1¼	16.1	12.9	10.7	9.2	8.1	7.2
1½	19.3	15.5	12.9	11.1	9.7	8.6
1¾	22.6	18.1	15.0	12.9	11.3	10.0
2	25.8	20.6	17.2	14.7	12.9	11.5

SEED REQUIREMENTS FOR 96 cm BETWEEN ROW SPACING (t/ha)

	In-Row Plant Spacing (cm)					
Seed Set Weight (g)	**20**	**25**	**30**	**35**	**40**	**45**
36	1.88	1.50	1.25	1.07	0.94	0.83
43	2.24	1.79	1.49	1.28	1.12	1.00
50	2.60	2.08	1.74	1.49	1.30	1.16
57	2.97	2.38	1.98	1.70	1.48	1.32

Fertilizer

Refer to *General Fertility Recommendations* on page 11 for information on macro and micro-nutrients.

Application of fertilizer should be made on the basis of recommendations developed from the analyses of soil samples submitted to the Manitoba Provincial Soil Testing Laboratory.

All fertilizer should be added as a sideband application when seeding. This offers the most efficient use of fertilizer. High rates of nitrogen may be broadcast or knifed in. However, do this as close to time of seeding as possible. Apply no more than 90 kg/ha (80 lb/acre) nitrogen in the urea form as a sideband when seeding. Anhydrous ammonia and aqua ammonia should be applied at least five days prior to seeding.

Where application according to soil test is not feasible, the general recommendations listed in the table below may improve yields (actual nutrients listed).

RATE OF NUTRIENTS TO ADD

Potatoes to be grown on	Nitrogen (N)[1] kg/ha	Nitrogen (N)[1] lb/acre	Phosphate (P_2O_5) kg/ha	Phosphate (P_2O_5) lb/acre	Potash (K_2O) kg/ha	Potash (K_2O) lb/acre	Sulphur (S) kg/ha	Sulphur (S) lb/acre
Fallow or legume breaking (2)	35-50	31-45	50-60	45-64	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	50-70	45-62	50-60	45-54	(3)	(3)	(4)	(4)
Stubble	70-100	62-89	50-60	45-54	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. A soil test is recomended or apply 50 to 90 kg/ha (45 to 80 lb/acre) of potash (K_2O).

(4) 10 to 30 kg/ha (9 to 27 lb/acre) of sulphur (S) are recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. Other soils may be sulphur deficient and on these a soil test is recommended.

Weed Control

Timely tillage with harrows, mulchers and cultivators supplemented with chemical weed control can be used to effectively control most weeds in potatoes. Timing of operations and chemical control measures must be selected for specific field conditions and weed problems.

Stale Seedbed

Refer to Stale Seedbed Weed Control on page 14.

Preplant Incorporated

Eptam 8-E (800 g/L, 8.00 lb/gal) Eptam 10 G (10%) Controls several annual grasses and broadleaf weeds. (Table 1)

Spring application Apply 4.25 to 5.5 L/ha (1.51 to 1.96 qt/acre) liquid or 34 to 45 kg/ha (30.3 to 40.2 lb/acre) granular product. Apply liquid in at least 100 L/ha (8.9 gal/acre) water. The granular product should be applied with a suitable granular applicator. Eptam must be applied to a dry soil surface of a well prepared seedbed. Incorporate immediately according to instructions on the product label or in the *1983 Guide to Chemical Weed Control.*

Fall application Apply 5.5 to 8.5 L/ha (1.96 to 3.03 qt/acre) liquid or 45 to 67 kg/ha (40.2 to 59.8 lb/acre) granular product in late fall prior to freeze-up. Apply liquid in at least 100 L/ha (8.9 gal/acre) water. Spray or broadcast on a dry soil surface. Incorporate immediately according to instructions on the product label or in the *1983 Guide to Chemical Weed Control.*

Quackgrass Control Spring or fall application. Apply 7 to 8.5 L/ha (2.49 to 3.03 qt/acre) liquid or 56 to 67 kg/ha (50.0 to 59.8 lb/acre) granular product. Apply liquid in at least 100 L/ha (8.9 gal/acre) water. Spray or broadcast on a dry soil surface. Incorporate immediately according to Chemical Weed Control.

Quackgrass must be cut up so that remaining rhizomes have four or less nodes prior to application.

Eptam 8-E may be applied with liquid fertilizer, or on granular fertilizer. Refer to the Herbicide Information section in the 1983 Guide to Chemical Weed Control for specific instructions regarding application and use on dry fertilizer.

Eptam 8-E (800 g/L, 8.00 lb/gal) plus Sencor 500 (500 g/L, 5.00 lb/gal) Controls annual grasses and several broadleaf weeds. (Table 1) Apply a tank mix of 550 to 850 mL/ha (7.83 to 12.1 oz/acre) Sencor 500 plus 4.25 to 5.5 L/ha (1.51 to 1.96 qt/acre) Eptam 8-E. Do not use on varieties Belleisle and Tobique or on soil with greater than 7 per cent organic matter. Refer to product label or 1983 Guide to Chemical Weed Control for incorporation instructions.

Caution: Fall seeded cover crops such as wheat, oats and rye may be injured when seeded the same season as application of Sencor. Rapeseed, sunflowers, sugar beets and several horticulture crops may be sensitive to Sencor residue the year following application. After harvest tillage practices that provide thorough mixing of the soil may be helpful in reducing the chance of injury to succeeding crops.

Preemergence

Basfapon (74%), Dalapon (74%), Dowpon (74%), Dowpon M (74%) Controls barnyard grass, green and yellow foxtail. Apply Basfapon at 5.5 to 7.75 kg/ha (4.91 to 6.91 lb/acre) in 200 to 400 L/ha (17.8 to 35.6 gal/acre) water, Dalapon at 3.25 to 6.75 kg/ha (2.90 to 6.02 lb/acre) in at least 200 L/ha (17.8 gal/acre) water, or Dowpon or Dowpon M at 3.4 to 6.8kg/ha (3.03 to 6.07 lb/acre) in at least 225 L/ha (20 gal/acre) water. Do not apply after potatoes emerge and do not use on red skinned varieties.

To control barnyard grass, green and yellow foxtail and broadleaf weeds (Table 1), apply a combination spray of 8.5 to 11 L/ha (2.85 to 3.92 qt/acre) Premerge 360 and 3.25 kg/ha (2.90 lb/acre) Dalapon in 250 to 400 L/ha (22.3 to 35.6 gal/acre) water, or 3.4 kg/ha (3.03 lb/acre) Dowpon or Dowpon M in 275 to 450 L/ha (24.5 to 40.1 gal/acre) water.

Do not use on red skinned varieties.

Dalapon see Basfapon

Dowpon, Dowpon M see Basfapon

Eptam 8-E (800 g/L, 8.00 lb/gal) - drag-off Controls several annual grasses and broadleaf weeds. (Table 1) Apply 4.25 to 8.5 L/ha (1.51 to 3.03 qt/acre). The field must first be "dragged-off", followed by Eptam 8-E application and incorporation. Use spike toothed har-

rows or cultivation equipment for incorporation. Refer to product label or *1983 Guide to Chemical Weed Control* for further incorporation and rate instructions.

Gramoxone (200 g/L, 2.00 lb/gal) Controls annual grasses, broadleaf weeds and top growth of perennial weeds. Apply 2.75 to 5.5 L/ha (0.98 to 1.96 qt/acre) in 300 to 1100 L/ha (26.7 to 97.9 gal/acre) clean water to emerged weeds. Use the higher rate when weeds are above 5 cm (2 inches) in height and the higher volume of water on dense weed growth. Do not apply if more than 30 per cent of the potatoes have emerged. Do not apply to emerged plants in the evening, under cloudy conditions, or when plants are under moisture stress. Potatoes grown for early harvest should not be treated after emergence.

Roundup (356 g/L, 3.56 lb/gal) Controls annual weeds. Apply 2.25 L/ha (0.80 qt/acre) in at least 100L/ha (8.9 gal/acre) water to actively growing grasses and broadleaf weeds less than 15 cm (6 inches) tall. If weeds are over 15 cm (6 inches) tall apply 3.5 L/ha (1.25 qt/acre). Apply to emerged weeds before or after planting, but before potatoes show above ground. Do not apply after potato emergence as Roundup will kill all green vegetation. Allow at least three days after treatment before disturbing the soil.

Controls perennial weeds. Refer to the Perennial Weed Control on Cropland section and the Special Weed Problems section in the *1983 Guide to Chemical Weed Control* for information on growth stages and rates of application. Also refer to product label.

Yellow Stuff PE (360 g/L, 3.6 lb/gal) Controls several weeds. (Table 1) Apply 8.5 to14 L/ha (3.03 to 5 qt/acre) in 400 to 500 L/ha (35.6 to 44.5 gal/acre) water just before emergence when no more than 5 per cent of the plants have emerged. Use the higher rate if grasses are a serious problem. If a few plants have emerged, leaves may be burned by the treatment but will recover.

Caution: Use rubber gloves, goggles and agricultural respirator when handling Yellow Stuff PE.

Postemergence

Eptam 8-E (800 g/L, 8.00 lb/gal) Sprinkler Irrigation Controls annual grasses and several broadleaf weeds. (Table 1) Meter 4.25 to 5.5 L/ha (1.51 to 1.96 qt/acre) into first irrigation water following a clean cultivation. Do not apply within 45 days of harvest.

Hoe Grass (190 g/L, 1.9 lb/gal) Controls certain annual grasses (Table 1). Apply 5.3 L/ha (1.87 qt/A) in at least 110 L/ha (9.8 gal/acre) water at a nozzle pressure of 275 kPa (40 psi). Direct nozzles 45° forward. Apply when weeds are in the one to four leaf stage, and before they tiller. Other postemergent herbicides must be applied at least four days before or after Hoe Grass application. Do not apply if rain is expected within one hour.

Sencor 500 (5.00 lb/acre, 500 g/L) Controls several broadleaf weeds. (Table 1) Apply 550 mL/ha (7.83 oz/acre) in 100 to 300 L/ha (8.9 to 26.7 gal/acre) water. Apply early postemergence soon after potatoes emerge and before weeds are 4 cm (1.5 inches) high. Do not use on the varieties Belleisle and Tobique. Do not use postemergence treatments on red skinned or on early maturing varieties. Do not apply within 60 days of harvest.

Disease Control

Practice crop rotations to prevent buildup in the soil of organisms that cause scab, black leg, Rhizoctonia and wilts. Avoid sunflowers, flax and rapeseed in the rotation. The plow down of a green cover crop of oats reduces rhizoctonia in the soil. Seed piece treatment reduces the risk of introducing diseases into a new field. For Verticillium wilt control treat seed pieces with thiophanate methyl (Easout). A crop rotation of four to five years is recommended. If a shorter rotation is being followed avoid sunflowers, sweet clover, tomatoes, peppers, eggplant and alfalfa which are susceptible to Verticillium wilt. Rotate with cereals.

Sanitation of all potato storage, handling and hauling equipment and disposal of all used bags is essential for bacterial ring rot control. Disinfect storages and equipment with a quaternary ammonia product such as Hy-X, Potato Gard, or Teramine, 0.6 L/160 L (one pint/35 gal) of water or household bleach, 5% solution at 700 ml/5L (20 oz/gal) water. Use high pressure washers or a steam cleaning unit to clean equipment before moving between fields, particularly for seed potatoes.

Dispose of culls carefully to prevent growth of plants. This helps to avoid contamination of the upcoming crop with bacterial ring rot or late blight. Care should be taken to plant potatoes in soil sufficiently warm for growth (approximately or 7 °C) in order to control blackleg, rhizoctonia and seed piece decay. A regular spray program will control early and late blight diseases.

Use of one or more of several fungicides according to directions on the label is recommended. Frequently, these disease control measures are combined with applications of insecticides where the mixture is compatible. Refer to Table 4 for Fungicide/Insecticide compatibility. Apply one of the following fungicides: maneb (Dithane M-22, Manzate D) at 2.2 kg/ha (2 lb/acre), mancozeb (Dithane M-45, Manzate 200) at 2.2 kg/ha (2 lb/acre), metiram (Polyram 80W) at 2.2 kg/ha (2 lb/acre), Difolatan 4.8F at 8.5 L/ha (1½ qt/acre), *Bravo 500 at 1.6-2.4 L/ha (24-36 oz/acre)* or fixed copper 49 to 55 per cent 1.1 to 3.3 kg/ha (1 to 3 lb/acre). Refer to page 9 for preharvest wait period.

To control the storage diseases, silver scurf and fusarium dry rot, avoid bruising potatoes when harvesting. Treat potatoes while going into storage with thiabendazole (Mertect 340F) at 284 ml/455 L (10 ounces/100 gal) water. Do not treat potatoes being exported with thiabendazole (Mertect) at the Canadian rates.

Insect Control

Leafhoppers, flea beetles, aphids and Colorado potato beetles are the major insects attacking potatoes in Manitoba. Aphids, because they transfer virus diseases, are of major concern to the seed grower. The following materials are suggested for insect control.

Flea beetles malathion 50EC at 2.2 L/ha (32 fluid ounces/acre) , Thiodan 4E at 1.4 L/ha (20 fluid ounces/

acre), or Guthion SC at 1.2 to 1.8 L/ha (17 to 25 fluid ounces/acre), or Supracide 25EC at 1.1 L/ha (16 fluid ounces/acre), or Belmark at 98 to 160 mL/ha (1.4 to 2.3 fluid ounces/acre). Follow label directions.

Colorado potato beetles Guthion SC at 1.2 to 1.8 L/ha (17 to 25 fluid ounces/acre), Thiodan 4E at 1.4 L/ha (20 fluid ounces/acre), Sevin 80S at 700 g/ha (10 ounces/acre), or Furadan 4.8F at 1.1 L/ha (16 fluid ounces/acre), or Monitor at 1.7 to 1.8 L/ha (24 to 26 fluid ounces/acre), or Supracide at 1.1 L/ha (16 fluid ounces/acre), or Belmark at 98 to 160 ml/ha (1.4 to 2.3 fluid ounces/acre), or Ambush 500 EC at 150 to 250 mL/ha (2.1 to 3.6 fluid ounces/acre), or Decis 2.5EC at 200 to 300 mL/ha (3 to 4 fluid ounces/acre), or Phorate 15G at 14.5 to 22.4 kg/ha (13 to 20 lbs/acre) to be applied at seeding. Follow label directions.

Potato leafhopper malathion 50EC at 1.7 L/ha (24 fluid ounces/acre) or Sevin 80S at 1.5 kg/ha (20 ounces/acre) or Belmark at 98 to 160 ml/ha (1.4 to 2.3 fluid ounces/acre) or Ambush 500EC at 150 to 250 ml/ha (2.1 to 3.6 fluid ounces/acre) or Supracide at 2.2 L/ha (32 fluid ounces/acre).

Aphids dimethoate 2E at 1.4 L/ha (20 fluid ounces/acre), malathion 50EC at 1.7 L/ha (24 fluid ounces/acre) or Thiodan 4E at 1.4 L/ha (20 fluid ounces/acre), or Belmark at 100 to 300 ml/ha (1.4 to 4.2 fluid ounces/acre).

Cutworms Apply Lorsban 4C at 1.4 to 2.8 L/ha (20 to 40 fl. oz./acre). Do not apply within 70 days of harvest. Apply Ambush 500EC at 0.14 L/ha (2.0 fluid ounces/acre) under good moisture conditions. Under dry conditions or when cutworm larvae are large and almost mature apply 0.23 to 0.30 L/ha (3.2 to 4.3 fluid ounces/acre).

Wireworms Broadcast Application Apply Dyfonate 10 G at 56 kg/ha (50 lbs/acre). Broadcast and incorporate into soil by discing or rototilling to a depth of 15 cm (6 inches) prior to planting.

Banded in furrow Application For irrigation soil only, apply Dyfonate 10G at 22.5 kg/ha (20 lb/acre) by regulated flow into fertilizer furrows at planting.

Sprout Inhibition

Field Application Apply maleic hydrazide (M.H.-30) at the rates recommended by the manufacturer. This should take place about two weeks after full bloom and only when plants are actively growing and tops are green and healthy.

Storage Application Inject CIPC as a mist or fog to the storage building after potatoes have gone through the suberization period. Potatoes should be free of excessive dirt and other debris and the storage should have a ventilation system that moves air through the pile. To date, CIPC has been available on a contract basis from Stanchem. Costs and other details are available from the Company. Care should be taken when treating Norchip with CIPC because of a short dormancy period. Treat early and do not ventiliate excessively.

Grading Application CIPC may be applied as a mist to tubers as they pass over the grader or through the wash line. This does not control sprouting in storage but is effective against the development of sprouts as the potatoes move through the market channels. Equipment to apply CIPC in this manner is not costly and the technique is suitable for growers with small or large volumes.

Vine Killing Use one of several dessicants such as dinoseb (e.g. dytop, Dow General liquid with oil, etc.) or diquat (Reglone) as recommended by manufacturers. They will kill the tops of the plants, encourage earlier maturity and a higher percentage of marketable tubers. If the crop is left unharvested after top killing for 10 to 20 days, skins will set. This helps minimize skinning and bruising during harvest.

Field to Storage Transport

Hauling potatoes from field to storage when tubers are exposed to the air results in the drying of bruised and cut tissue. This dry surface prevents suberization and leaves the damaged areas open to infection and subsequent decay. Loads of potatoes should be covered with tarpaulins to protect the exposed tubers that are in transit or being held on the truck. This will increase relative humidity thereby reducing drying and allowing suberization to take place.

For the same reason it is important to protect cut seed from drying. Unsuberized seed is subject to a greater loss by seed piece decay.

Storage

The initial storage period is critical. Potatoes in which soft rot may develop should have initial storage temperatures of 8-10°C. Soft rot development can be expected when blackleg or frost are present. Where fusarium dry rot is present; initial storage temperatures of 10-18°C are most beneficial. Fusarium dry rot is most serious when soil conditions are dry and when tubers are injured during harvest. These conditions should be held for the first 10 to 14 days. Follow this period with a gradual drop in temperature while humidity is maintained at a minimum of 90 per cent. Operate humidification equipment in conjunction with fans. Humidifers should be used whenever fans operate as long as the air entering the pile is at least slightly below tuber temperature. Exceptions to these conditions include potatoes which are damaged by fall frost or potatoes which develop the disease leak (usually result from harvesting when tuber/soil temperature is high). Under these circumstances it may be necessary to circulate the air at a lower relative humidity, (perhaps 80 per cent) through the pile until the condition is reduced.

Mechanical Damage

The greatest single cause of loss of tubers of marketable size and type is from mechanical damage. In the majority of cases storage rot problems are a direct result of damage inflicted on the tuber during harvesting and handling. Most organisms attacking the potato cannot penetrate the unbroken skin of the tuber. However, when the tuber is cut, bruised, squashed or otherwise mechanically damaged, a wide range of soil borne organisms are able to attack the tuber causing a rotting of the tissue.

Experiments indicate that many growers lose at least 15 per cent of the No. 1 grade potatoes they grow through mechanical injury. Prevent loss from mechanical injury by slowing down conveyors so they run full, reduce distances the tubers drop and roll, and provide adequate instruction, supervision and incentives for workers. Make sure trucks are filled in layers and piling in storage is done in steps to reduce rollback.

Good management of the harvest operation pays high dividends in reduced shrink in storage, higher percentage of No. 1 grade produce and higher net return per acre. In Idaho it is estimated that losses from bruising cost from $70 to $80 per acre. Losses in Manitoba are also very substantial.

Bruise Detection

Catechol System

Equipment:

- plastic pail
- plastic mesh bag or perforated plastic pail to fit inside the above.
- rubber gloves
- plastic funnel
- plastic jug (opaque)
- solution - 1% catechol, 99% water

Method Pour the solution in a plastic pail. Place tubers into mesh bag, immerse in catechol solution for one minute, remove, drain, and let stand for 5 to 10 minutes. After dipping samples, the solution may be stored in the plastic jug.

Results Exposed bruised tissue will turn red and later reddish brown.

Sources of supply are:

Fisher Scientific
18 Plymouth
Winnipeg, Man.

Chemonics Scientific Ltd.
78 Durand
Winnipeg, Man.

Canlab
590 Moray
Winnipeg, Man.

Time Delay System

Damaged tissue under an unbroken skin will not develop the reddish brown color when the catechol method is used. A complete appraisal of damage may be accomplished by peeling tubers 24 to 48 hours after the injury has occurred. The damaged areas will show up as grey to black spots in the white flesh of the peeled tuber.

Special Note

Where potatoes are being grown for a processing firm, take particular note of the company's recommendations in connection with insecticides, fungicides, top killers, sprout inhibitors and storage conditions. If company recommendations differ from those above, follow company specifications.

Radish

Varieties

Champion; Scarlet Knight; Cherry Belle.

Seed Treatment

Dust seed with thiram or captan seed protectant at 5 mL/454 g (one teaspoonful per pound) of seed.

Seeding and Spacing

Seed Sow seeds 1.3 cm (one half inch deep) at a rate of 11 to 16 kg/ha (10 to 15 lb/acre); 11 to 33 kg/ha (10 to 30 lb/acre) for machine harvesting.

Spacing Radishes are resistant to several degrees of frost, so seeding may start as soon as the land is ready in the spring. Maturity is reached in 21 to 26 days or longer in cool weather. Consecutive plantings can lengthen harvest period. Radishes are grown successfuly on peat land throughout the summer months. Only short to medium foliage varieties should be used.

Fertilizer

Apply 56 kg/ha (50 lb/acre) N and 56 kg/ha (50 lb/acre) P_2O_5 as a broadcast operation before planting. Incorporate into the top 7.5 cm (3 inches). For potassium and sulphur requirements refer to *General Fertility Recommendations*.

Weed Control

There are no recommended herbicides for radish.

Insect Control

Flea beetles Spray with malathion 50EC at 1.1 L/ha (16 fluid ounces/acre) or with Sevin 80S at 1.4 kg/ha (20 fluid ounces/acre) just after plants emerge. Repeat as required.

Radish maggot Apply with diazinon 5G at 560 g/300 m row) (20 fluid ounces/1000 feet row) as plants emerge.

Rutabagas (Swede Turnip)

Varieties

Laurentian

Seeding

Dates:

Early Market: Plant in mid May when soil conditions are suitable and fear of heavy spring frosts is past.

Main Crop: Sow about the 8 June. This date may be set back two weeks if irrigation is available to maintain continuous growth.

Spacing Row spacing varies from 60 to 93 cm (24 to 36 inches). Sow 561 g to 1.1 kg/ha (one half to 1 lb/acre) seed per acre depending on seed bed conditions.

Row Spacing Plants should be thinned to 12.5 cm (5 inches) in the row when they are 5 to 7.5 cm (2 to 3 inches) high. If a precision seeder is used, place the seed 10 cm (4 inches) apart in the row.

Fertilizer

Fertilizer is not recommended for the main storage crop. Excess fertility causes rapid growth and cracking under ideal growing conditions.

Boron deficiency — (Water-core, Brown Heart) As a preventative measure broadcast 22 kg/ha (20 lb per/acre) borax and work in prior to seeding. A foliar spray may be used. Reduce the rate to 4.5 kg/ha (4 lb/acre). Fields to which borax has been applied should not be planted to beans or cucumbers the following year as they are extremely sensitive to boron.

Growth Cracks Under rapid growing conditions the roots tend to crack at the shoulder and in severe cases the full length of the root. To prevent this clip as much as 25 per cent of the tops off with a rotary mower. Under very favorable conditions it may be necessary to repeat this operation. This will also prevent the crop from growing oversized before harvest for winter storage.

Weed Control

Stale Seedbed

Refer to Stale Seedbed Weed Control on page 14.

Preplant Incorporated - 6 to 10 days before planting.

Eptam 8-E (800 g/L, 8.00 lb/gal), Eptam 10 G (10%) Controls annual grasses and several broadleaf weeds. (Table 1) Apply 3.25 to 4.25 L/ha (1.16 to 1.51 qt/acre) or 22.5 to 34 kg/ha (20.07 to 30.33 lb/acre) granular product. Apply liquid in at least 100 L/ha (8.9 gal/acre) water. The granular product should be applied using a suitable granular applicator. Eptam must be applied to a dry soil surface of a well prepared seedbed. See product label or *1983 Guide to Chemical Weed Control* for information on incorporation.

Caution: If dry weather prevails at the time of application, do not use Eptam on sand and use the lower rate on medium and heavy soils.

Treflan EC (545 g/L, 5.45 lb/gal) Controls green and yellow foxtail, wild oats and other broadleaf weeds (Table 1). Spring application only. Apply 1.5 to 2.0 L/ha (0.53 to 0.72 qt/acre) in at least 100 L/ha (8.9 gal/acre) water. See product label or *1983 Guide to Chemical Weed Control* for rate and incorporation instructions.

Treflan EC (400 g/L, 4.00 lb/gal) Controls green and yellow foxtail, wild oats and several broadleaf weeds. (Table 1) Spring application only. Apply 2 to 2.75 L/ha (0.71 to 0.98 qt/acre) in at least 100 L/ha (8.9 gal/acre) water. Refer to product label or *1983 Guide to Chemical Weed Control* for rate and incorporation instructions.

Disease Control

Clubroot Refer to Cabbage, Cauliflower, Brussel Sprouts, Broccoli "Disease Control" section.

Blackleg and Black Rot Rotate crops - do not plant turnips, rape, cabbage and other crucifers more than once every three years on the same land. Sow seed which has been hot water treated for 20 minutes at 50°C. Avoid field work when foliage is wet.

Soft Rot Control root feeding insects such as maggots. Avoid bruising roots as much as possible during cultivation and harvesting. Harvest under dry conditions if possible. Store close to O°C and 95 per cent humidity (see harvesting and storing section). If soft rot of the trimmed surface appears, trim the roots after the initial pre-soaking to remove adhering soil. Use clean water for final rinsing. Dry roots after washing and store at a cool temperature until shipped. Disinfect storage bins with a 2 per cent copper sulphate solution or other disinfectant pior to harvest.

Brown Heart, Water-core (see boron deficiency under **Fertilizer).**

Insect Control

Root maggots Do not grow rutabagas near a previously infested field, or an early sown field of cabbage or cauliflower. Apply Dasanit 15G at 925 g/300 m row (13.3 oz/1000 feet row) in a 15 cm (6 inch) band over the row and incorporate in the top 2.5 cm (1 inch) of soil and seed into the centre of the row, or Furadan 10G at 567 g/300 m row (20 ounces/1000 feet row). Apply granules in 10 cm (4 inch) band, 2.5 cm (1 inch) below soil surface. Plant seed 1 cm (half-inch) above centre of band. This may be followed by an overall spray of Furadan 4.8F at 1.1 L/ha (16 ounces/acre) or diazinon 4E at 1.4 L/ha (20 fluid ounces/acre) in early July and again in mid-August to control the maggot flies.

Caution: If Furadan is applied, only one application is permitted on products grown for export.

Flea beetles Spray with malathion 50EC at 2.2 L/ha (32 fluid ounces/acre) or Thiodan 4E at 2 to 3 L/ha (30 to 40 fluid ounces/acre) as plants emerge and repeat as required.

Aphids If the crop is attacked, spray with either malathion 50EC at 2.2 L/ha (32 fluid ounces/acre) or Thiodan 4E at 2.1 L/ha (30 fluid ounces/acre) in at least 224 L (20 gal) water.

Note: Do not feed rutabaga refuse treated with Thiodan (Endosulfan) to livestock or poultry.

Harvesting and Storing

If possible, harvest when weather is cool and avoid bruising. Roots will store up to eight months if temperatures are held at 0 °C and a relative humidity of 95 per cent. Remove field heat as rapidly as possible to prevent initial shrinkage and discoloration. If forced air is used, additional moisture should be added to the air stream. Do not soak pile with water hose.

Trimming When preparing roots for market, the top should be removed at the crown. Trimming into the crown should be avoided. Remove side rootlets and the main tap root below the enlarged area of the root.

Tomatoes

Varieties

Staking Fantastic. Moreton Hybrid, Valiant, Better Boy, Early Cascade.

Bush Prairie Pride, Mustang, Starfire, Manitoba, Swift, Saladette, Earlirouge

Transplants

Plants for transplanting should be strong and vigorous with no signs of disease. Too early plantings should be avoided. Four to 7-week old seedlings have proven as much or more productive than 11-week old plants. Severe hardening is not recommended as recovery is slow and delays maturity.

The number of flowers and fruit on the first two to three clusters will increase if seedlings are grown at night temperatures 10 ° to 13 °C for a period of 3 weeks after the first true leaf appears. This may be done before or after the first transplanting. Return the seedlings to temperatures of 15 ° to 18 °C after this treatment.

Row Spacing *Staking* — 1 m x 45 cm (3.5 feet x 18 inches)
Bush — 1.2 m x 45 cm (4 feet x 18 inches)

Seed Treatment

Use hot water treated seed from a reliable seed source or apply 75 per cent thiram or 75 per cent captan seed protectants (if seed not already treated).

Fertilizer

To reduce the setback in transplanting, use a high phosphorus fertilizer such as 10-52-17. Mix at the rate of 454 *g*/ 45 L (1 lb/10 gal) water and apply 284 mL (10 fluid ounces) per plant.

Growers should always base fertilizer applications on the results of annual soil tests. Care should be taken in application of nitrogen. Too much will cause excessive vegetative growth, delayed maturity, or lack of fruit set. Bring nitrogen up to 100 to 112 kg/ha (90 to 100 lbs/acre) and phosphorous up to 112 kg/ha (100 lbs/acre). For potassium and sulphur requirements refer to General Fertility Recommendations.

Weed Control

Preplant Incorporated

Treflan EC (545 g/L, 5.45 lb/gal) Controls green and yellow foxtail, wild oats and other broadleaf weeds (Table 1). Spring application only. Apply 1.5 to 2.0 L/ha (0.53 to 0.72 qt/acre) in at least 100 L/ha (8.9 gal/acre) water. See product label or *1983 Guide to Chemical Weed Control* for rate and incorporation instructions.

Treflan EC (400 g/L, 4.00 lb/gal) Controls green and yellow foxtail and several broadleaf weeds. (Table 1) Spring application only. Apply 2 to 2.75 L/ha (0.71 to 0.98 qt/acre) in at least 100 L/ha (8.9 gal/acre) water. See product label or *1983 Guide to Chemical Weed Control* for rate and incorporation instructions.

Disease Control

Early blight, late blight, Septoria leaf spot Treat with one of the following in early July when the first fruit reaches golf ball size or when first signs of leaf spotting occurs:

Maneb (Dithane M22, Manzate D), 3.4 kg/ha (3 lb/acre)

Mancozeb (Dithane M45, Manzate 200), 3.4 kg/ha (3 lb/acre)

Captafol 4.8F at 2.75-5.5 L/ha (40-80 oz/acre).

Metiram (Polyram 80W), 3.4 kg/ha (3 lb/acre)

Chlorothalonil (Bravo 500) at 2.4-4.0 L/ha (36-60 oz/acre).

Zineb (Dithane Z78), 3.4 kg/ha (3 lb/acre)

or fixed coppers 49 to 55 per cent (Kocide 101, Tricop, neutro-cop) at 3.4 to 5.6 kg/ha (3 to 5 lb/acre).

Repeat every 7 to 10 days. Follow manufacturer's directions.

Blossom end rot Maintain uniform soil moisture throughout the growing season and avoid close cultivation. If blossom end rot occurs, apply 2.3 to 5.6 kg/ha (2 to 5 lb/acre) calcium chloride as a spray during the fruit development period, particularly during periods of hot humid weather. Repeat applications weekly at a lower rate.

Physiological Leaf Roll This condition occurs quite often just prior to ripening of the first fruits. It is more common on staking varieties than on bush types. Symptons are thickening of the lower leaves accompanied by a tendency to roll inwards. The leaves become very brittle and damage easily. Leaf roll may be caused by irregular water supply or severe pruning. It is a temporary condition and appears to have no effect on crop yield or quality.

Verticilluim Wilt Follow crop rotation by allowing 3 to 4 years between successive crops. Do not include peppers, eggplant, sunflowers, alfalfa, sweet clover or potatoes in the rotation.

Sun Scald See Peppers for description of injury.

Insect Control

Flea beetles Spray with malathion 50EC at 1.1 L/ha (16 fluid ounces/acre) or Thiodan 4E at 1.4 L/ha (20 fluid ounces/acre).

Variegated cutworm Spray Sevin 80S (in evening) at 1.4 to 2.8 kg/ha (20 to 40 ounces/acre) or thiodan 4E at 1.4 L/ha (20 fluid ounces/acre).

Slugs See slugs under **Celery** and **General Pesticide Recommendations.**

Artificial Ripening of Mature Greens

For all around color, flavor and handling ability, ripen mature green tomatoes at 21°C.

Tomatoes develop their most intensive red color and flavor when held at 21°C for ripening. At temperatures above 24°C the fruit ripens on the soft side lacking flavor,

color and firmness. If they are held at temperatures below 10°C for extended periods of time, the fruit will not ripen fully even though it is returned to ideal ripening conditions. After the fruit has reached a firm/ripe stage it may be held at temperatures of 7°C without loss of color or flavor.

Seed Companies

These seed companies are commonly used by vegetable growers. However, the list is neither an endorsement of them or a suggestion that other companies do not supply vegetable seed. It is only provided as information for growers:

Abbot & Cobb
4744-46 Frankford Ave.
Philadelphia, Pa. 19124

Agway Inc. Seed Division
Box 1333
Syracuse, N.Y. 13201

Alberta Nurseries and Seeds Ltd.
Box 20
Bowden, Alberta T0M 0K0

Asgrow Seed Co. of Canada Ltd.
P. O. Box 715
Bradford, Ontario

Asmer Seeds Limited
Asmer House
Ash Street
Leicester, England L35 0DD

W. Atlee Burpee Co.
615 N. Second Street
Box B - 2001
Clinton, Iowa 52732

B.C. Pea Growers
Brooks, Alberta T0J 0J0
C. Beemsterboer N.V.

Seed Growers and Merchants
Warmenhuizen, Holland

Buckerfields
Box 7000
Vancouver, B.C.

D.V. Burrell Seed Growers Co.
P. O. Box 150
Rocky Ford, Colorado 81067

Crookham Co.
P. O. Box 520
Caldwell, Idaho 83605

De Giorgi Company Inc.
1411 Third Street
Council Bluffs, Iowa 51501

Dominion Seedhouse
Georgetown, Ontario

Ferry-Morse Seed Co.
111 Ferry-Morse Way
P. O. Box 100
Mountain View, Cal. 94040

FMC Export Corporation (Niagara)
Agricultural Chemical Division
Box 3091
Modesto, California 95353

Gallatin Valley Seed Co.
Box 167
Twin Falls, Idaho 83301

Golden West Seeds Ltd.
1108-6th Street S.E.
Calgary, Alberta T2G2Y2

Harris Seeds of Canada
RR 2
Hamilton, Ontario L8N 2Z7

Herbst Brothers Seedsmen
1000 N. Main Street
Brewster, N.Y. 10509

Kackenhoff Nurseries Ltd.
Lt 41
St. Norbert, Man.

Keystone Seed Co.
P. O. Box 1438
Hollister, California 95023

Lindenberg Seeds Ltd.
803 Princess Ave.
Brandon, Man.

McFayden Seeds
P. O. Box 1600
Brandon, Manitoba R7A 6A6

McKenzie Steel Briggs Seeds
Box 636
Brandon, Man.

Northrup, King & Co.
P.O. Box 959
Minneapolis, Minnesota 55440

W. H. Perron & Co. Ltd.
515 Labelle Boulevard
Lavel, Quebec H7S 2A6

Peto Seed Co.
Box 4206
Saticoy, Cal. 93003

Pike's Seedsmen and Florists
10039-101A Avenue
Edmonton, Alberta T5J 0C7

Robertson Seeds Ltd.
8118-103rd Street
Edmonton, Alberta T6E 4B1

Rogers Seed Co.
P. O. Box 2188
Idaho Falls, Idaho 83401

Royal Sluis
Box 22
Enkhuizen, Holland

Seed Center Ltd.
Box 3867
9939-118 Avenue
Edmonton, Alberta

Seedway Inc.
Hall, New York 14463

Charles Sharpe and Co. Ltd.
Sleaford Lincs, England

Siegers Seed Co.
7245 Imlay City Rd.
Imlay City, Michigan 48444

Sluis and Groot of America Inc.
P. O. Box 580
Menlo Park, California 94025

Steele-Briggs Seeds
1206-45 Avenue N.E.
Calgary, Alberta

Stokes Seeds Ltd.
Box 10
St. Catharines, Ontario L2R 6R6

Takii and Co.
622-18th Avenue
San Francisco, California 94121

T & T Seeds Ltd.
120 Lombard Avenue
Winnipeg 2, Manitoba R3B 0W3

Otis S. Twilley Seed Co.
Salisbury, Maryland 21801

H. J. Unwin Limited
Histon, Cambridge
England CB4 4LE

Vesey's Seeds Ltd.
York, Prince Edward Island

Westcan Horticultural Specialists Ltd.
1900-11th Street S.E.
Calgary, Alberta T2G 3G2

William Dam Seeds
Highway 8
West Flamboro, Ontario

Certified Seed Potato Producers in Manitoba

A & M Potato Growers, Wellwood, Manitoba.

K & B Seeds Ltd.,
Box 2110, Winkler, Manitoba R0G 2X0

Kroeker Farms Ltd.,
Box 1450, Winkler, Manitoba R0G 2X0

Goertzen Bros. Ltd.,
Box 2290, Winkler, Manitoba R0G 2X0

M. J. Gowryluk & Sons Ltd.,
Box 144, Holland, Manitoba R0G 0X0

Swans Fleet Farms Ltd., Bruxelles, Manitoba R0G 0G0

Vista Farms Ltd.,
Box 73, Plum Coulee, Manitoba R0G 1R0

Detailed information on certification class, varieties and volumes of seed for sale can be obtained by contacting the Manitoba Vegetable Producers Marketing Board, 1200 King Edward Street, Winnipeg, Manitoba, R3H 0R5 (204) 633-9336 or the growers directly.

Metric Equivalents

Volume (liquid)		
fluid ounce (Imp)	=	28.412 mL
pint	=	0.568 litre
gallon	=	4.546 litres
litre	=	35.2 fluid oz
hectolitre	=	26.418 gal
Length		
inch	=	2.54 cm
foot	=	0.3048 m
yard	=	0.914 m
mile	=	1.609 km
millimetre	=	0.039 in
centimetre	=	0.394 in
decimetre	=	3.937 in
metre	=	3.28 ft
kilometre	=	0.621 mile
Volume (dry)		
cubic inch	=	16.387 cm^3
cubic foot	=	0.028 m^3
cubic yard	=	0.765 m^3
bushel	=	36.368 litres
board foot	=	0.0024 m^3
cm^3	=	0.061 cu in
m^3	=	31.338 cu ft
hectolitre	=	2.8 bu
m^3	=	1.308 cu yd
Proportion		
1 gal/acre	=	11.232 litres/ha
1 lb/acre	=	1.120 kg/ha
1 lb/sq in	=	0.0702 kg/cm^2
1 bu/acre	=	0.898 hL/ha
1 litre/ha	=	14.24 fluid oz/acre
1 kg/ha	=	14.5 oz avdp/acre
1 kg/cm^2	=	14.227 lb/sq in.
1 hL/ha	=	1.112 bu/acre
Area		
square inch	=	6.452 cm^2
square foot	=	0.093 m^2
square yard	=	0.836 m^2
square mile	=	2.59 km^2
acre	=	0.405 ha
cm^2	=	0.155 sq in
m^2	=	1.196 sq yd
km^2	=	0.386 sq mile
ha	=	2.471 acres
Weight		
ounce	=	28.349 g
pound	=	453.592 g
hundredweight (Imp)	=	45.359 kg
ton	=	0.907 tonne
gram	=	0.035 oz avdp
kilogram	=	2.205 lb avdp
tonne	=	1.102 short ton

Temperature

°F	=	(°C x 1.8) + 32
°C	=	(°F — 32) x 5/9

Conversion Factors

Imperial units	Approximate conversion factor	Results in:
Linear		
inch	x 25	millimetre (mm)
foot	x 30	centimetre (cm)
yard	x 0.9	metre (m)
mile	x 1.6	kilometre (km)
Area		
square inch	x 6.5	sq centimetre (cm^2)
square foot	x 0.09	square metre (m^2)
acre	x 0.40	hectare (ha)
Volume		
cubic inch	x 16	cu centimetre (cm^2)
cubic foot	x 28	cubic decimetre (dm^3)
cubic yard	x 0.8	cubic metre (m^3)
fluid ounce	x 28	millilitre (mL)
pint	x 0.57	litre (L)
quart	x 1.1	litre (L)
gallon	x 4.5	litre (L)
bushel	x 0.36	hectolitre (hL)
Weight		
ounce	x 28	gram(g)
pound	x 0.45	kilogram (kg)
short ton (2000 lb)	x 0.9	tonne (1)
Pressure		
pound per square inch	x 6.9	kilopascal (kPa)
Power		
horsepower	x 746	watt (W)
	x 0.75	kilowatt (kW)
Speed		
feet per second	x 0.30	metres per second (m/s)
miles per hour	x 1.6	kilometres per hour (km/h)
Agriculture		
gallons per acre	x 11.23	litres per hectare (L/ha)
quarts per acre	x 2.8	litres per hectare (L/ha)
pints per acre	x 1.4	litres per hectare (L/ha)
fluid ounces per acre	x 70	millilitres per hectare (mL/ha)
tons per acre	x 2.24	tonne per hectare (t/ha)
pounds per acre	x 1.12	kilograms per hectare (kg/ha)
ounces per acre	x 70	grams per hectare (g/ha)
plants per acre	x 2.47	plants per hectare (plants/ha)

Abbreviations and Useful Measurements

E	=	emulsion, emulsible
EC	=	emulsifiable concentrate
W	=	wettable
WP	=	wettable powder
%	=	per cent
/A	=	per acre

1 imperial gallon = 4 quarts = 8 pints = 160 fluid ounces
1 U.S. gallon = 5/6 imperial gallon
1 imperial quart = 40 fluid ounces
1 imperial pint = 20 fluid ounces
1 mile = 5280 feet = 1760 yards = 320 rods
1 rod = 16.5 feet = 5.5 yards
1 acre = 43,560 square feet = 4,840 square yards = 160 square rods
1 mile an hour = 88 feet/minute

Related Publications

These publications are available from the Publications Section, Manitoba Agriculture, 411 York Avenue, Winnipeg, Manitoba R3C 1M5.

Manitoba Agriculture Publications

Diseases of Vegetables and Special Crops
Insect Control on Vegetables
Sweet Corn Production in Manitoba
Growing Potatoes in the Home Garden
Recommended List of Vegetables for Manitoba
Tomatoes in the Home Garden
Guide to Chemical Weed Control
Fertilizer Recommendations for the Home Garden
Vegetable Disease Protection Calendar for Manitoba
Grasshopper Control in Manitoba
Insects and Mites of Manitoba
Nitrogen Fixation and Legumes in Crop Production
Nitrogen Fertilization in Crop Production
Phosphorous Fertilization in Crop Production
Soil Testing Services in Manitoba
Micronutrients in Crop Production
Plant Tissue Analysis
Calculating Nutrient Costs and Fertilizer Rates
A Consensus Budget of Costs and Returns for Table Carrot Production

Agriculture Canada Publications

Growing Vegetables in the Prairie Gardens (# 1033)
Home Storage Room for Fruits and Vegetables (# 1478)
Diseases and Pests of Potatoes (# 1492)
Growing Garden Tomatoes (# 1558)
Home Vegetable Growing (# 1059)
Tomato Diseases (# 1479)
Cucumber Diseases (# 1684)
Commercial Storage of Fruits and Vegetables (# 1532)
The Waxing of Turnips for the Retail Market (# 1120)
Growing Rutabagas (# 1355)

Table 1 — Herbicides Recommended for Weed Control in Vegetable Crops

HERBICIDES	CROPS: Asparagus	Beans (Snap)	Beets	Broccoli, Brussel Sprouts	Cabbage, Cauliflower	Carrots	Celery	Corn (Sweet)	Cucumbers (Fresh/Processed)	Onions	Parsnips	Peppers	Potatoes	Rutabagas	Tomatoes
Afolan F, Lorox L	X				X	X[1]				X[1]					
AWK *1					X					X					
Amitrol T	X														
Basfapon/Dalapon/Dowpon/Dowpon M	X											X			
Basagran		X						X							
CIPC + Randox									X						
2,4 D	X							X							
Dual								X							
Dyanap									X						
Eptam 8-E, Eptam 10-G		X										X	X		
Fradicane 8-E								X[b]							
Gramoxone (pre to crop)	X					X				X		X			
Gramoxone (stale seedbed)		X	X	X[1]	X[1]	X		X	X	X		X	X		
Hoe Grass						X				X[d]		X			
Kil Mor								X							
Lasso								X							
Na Ta TCA			X												
Pardner, Torch								X							
Prefar									X						
Prefar + Alanap 3[7]									X						
Premerge 360/Sinox PE/Yellowstuff PE		X						X[2]				X[2]			
Primextra[3]								X							
Princep Nine-T/Simadex/Simadex 80W	X														
Randox									X						
Ro-Neet 7.2E			X												
Roundup — Pre to Crop												X			
Sencor 500												X			
Sencor 500 + Eptam 8-E												X			
Sutan +								X							
Sutan + Aatrex, Atrazine[3]								X							
Totril									X						
Treflan EC		X		X	X	X					X		X	X	

WEEDS: Barnyard Grass	Bindweed (Field)	Blue Bur	Buckwheat, Tartary	Buckwheat, Wild	Catchfly (Night Flowering)	Chickweed, Common	Cocklebur	Cow Cockle	Field Horsetail	Flixweed	Foxtail (Green)	Foxtail (Yellow)	Goosefoot (Oak Leaved)	Groundsel, Common	Hemp Nettle	Knotweed (Prostrate)	Kochia	Lamb's Quarters	Lettuce (Prickly)	Milkweeds	Mustard (Ball)	Mustard (Dog)	Mustard (Hare's Ear)	Mustard, Indian	Mustard, Tumble	Mustard, Wild	Pigweed, Wormseed	Pigweed, Prostrate	Pigweed, Red Root	Pigweed, Russian	Purslane	Quackgrass	Ragweed, Common	Ragweed, False	Ragweed, Giant	Shepherd's Purse	Smartweed, Lady's Thumb	Sow Thistle (Annual)	Sow Thistle (Perennial)	Spurge, Leafy	Spurge, Thyme-Leaved	Stinkweed	Thistle, Canada	Thistle, Russian	Toad Flax	Volunteer Corn	Volunteer Rapeseed	Wild Oats	Wild Radish
Afolan F, Lorox L	●			●		●				S	S			●	●	●	●								●	○	●			●		●	●	●	●	●	●				●								●
AWK *1	●									●	●						●										●			●																	●		
Amitrol T								●											●												●											●		●					
Basfapon/Dalapon/Dowpon/Dowpon M										●	●																				●[d]																		
Basagran		●[e]				●	●						●				●							●			●			●		●		●			●											
CIPC + Randox	●					●				●	●						●								●	●	●	●	●	●		●	●	●		●												
2,4 D		●					●		*			●				*	●		*	●	*	*	*	*	*			*	○	●		*	*	*	*		●	□		*		●			○		●
Dual	●									●	●																																					
Dyanap	●									●	●						●			●	●	●	●	●	●	●	●	●	●	●		●	●	●														
Eptam 8-E, Eptam 10-G	●					●				●	●						●									●	●		●	●	S[b]																●		
Fradicane 8-E	●					●				●	●														●	●	●			●	S															●		
Gramoxone (pre to crop)	Controls Annual Weed Seedlings and Top Growth of Perennial Weeds																																															
Gramoxone (stale seedbed)	Controls Annual Weed Seedlings and Top Growth of Perennial Weeds																																															
Hoe Grass	●										●	●																																		●		●
Kil Mor		□	○	●	●	○		●	●		●					●	○	●			●	●	●	●	●	●	●	●	○			●	●	●	●	●	●	□		●		●			○		
Lasso	●										●	●																																				
Na Ta TCA											●	●																																				
Pardner, Torch				●	●			●									●							●													●			●		●						
Prefar	●										●	●																																				
Prefar + Alanap 3[7]	●	●				●	●				●	●					●														●		●	●	●												
Premerge 360/Sinox PE/Yellowstuff PE																								●																						●		
Primextra[3]	●			●							●	●					●							●		●					●		●														
Princep Nine-T/Simadex/Simadex 80W	●		●		●	●	●		●			●		●	●	○	●	●		●	●	●	●	●	●	●	○		●	●		●	●	●	●	●	●			●						●	●
Randox	●										●	●					●									●	●	●	●	●		●	●	●													
Ro-Neet 7.2E	●										●	●					●										●			●																	●	
Roundup — Pre to Crop	Controls Annual Weed Seedlings and Top Growth of Perennial Weeds[c]																																															
Sencor 500				●		●								●		●		●					●											●					●					●			
Sencor 500 + Eptam 8-E	●			●		●				●	●			●		●		●					●			●	●		●	●	S						●			●					●	●	
Sutan +	●									●	●																																					
Sutan + Aatrex, Atrazine[3]	●			●						●	●						●							●		●		●			●																	●	
Totril				●		●							●	●			●				●			●		●	●	●	●	●																		●
Treflan EC	●			●		●		●		●	●				○	●											●			●																	●	

LEGEND: HERBICIDES AND CROPS

X — Recommended on crop

[1] — Afolan only

[2] — Yellow Stuff PE only

[3] — These treatments may remain as a residue in the soil the following year. Flax, peas and fababeans are more tolerant crops.

[4] — Dry bulb onion only

[5] — Refer to Sweet Corn section for tolerant varieties

[6] — For use on Cabbage, Cauliflower and Brussel Sprouts only

[7] — Preemergent — Do not use Alanap[3] on Butternut Squash

LEGEND: WEEDS

● — Controlled by maximum rates recommended for crops. Where two brand names are recommended, the weed may not appear on both labels.

S — Suppression

○ — Not labelled for control but adequate control can be expected

□ — Top growth control only

* — Controlled by rates less than the maximum recommended for crops

[d] — Split application required for adequate control

[b] — For control, quackgrass must be cut up so that the remaining plant parts are 5 cm (2 inches) or less or 4 nodes or less in length prior to application. RATES REQUIRED TO CONTROL QUACK GRASS CAN BE USED IN POTATOES ONLY.

[e] — Apply to emerged weeds before or after planting, but before potatoes emerge.

[d] — Quackgrass control in asparagus only.

Table 2~Insecticides Recommended for Insect Control in Vegetable Crops

INSECTICIDES	REGISTERED CROPS: Bean (Snap)	Beets (Red)	Cabbage, Cauliflower, Brussel Sprouts, Broccoli	Carrots	Celery	Corn (Sweet)	Cucumbers, Pumpkins, Squash	Eggplant	Lettuce	Onion	Peppers	Potatoes	Radish	Rutabagas	Tomatoes	INSECTS: Aphids	Cabbage Looper	Cabbage Worm	Colorado Potato Beetle	Corn Earworm	Cucumber Beetle	Diamond Back Moth Larvae	European Corn Borer	Flea Beetle	Leaf Hopper	Leaf Miners	Maggot Flies	Onion Maggots	Onion Maggot Flies, Thrips	Pepper Maggot	Potato Leaf Hopper	Radish Maggot	Root Maggots	Slugs	Tarnished Plant Bug	Variegated Cutworm	Wireworm
Ambush		•			•						•						x	x	x	x		x	x		x					x				x			
Bacillus Thuringiensis		•															x	x				x															
Belmark		•									•					x	x	x	x			x		x	x					x							
Birlane		•																														x					
Cygon, Rogor	•	•								•	•					x								x					x					x			
Dasinit		•							•[A]				•													x					x						
Decis		•[C]									•						x	x	x			x															
Diazinon	•	•	•						•			•	•				x	x				x				x	x	x	x			x					
Dyfonate											•																								x		
Furadan				•		•					•		•						x	x				x		x[1]						x[1]					
Guthion							•				•								x					x													
Lannate			•			•											x	x		x		x	x														
Lorsban										•[B]		•							x								x										
Malathion	•	•	•	•	•		•	•	•		•	•	•	•	•	x								x	x	x				x				x			
Metaldehyde			•		•										•																			x				
Monitor			•									•				x	x	x	x			x															
Rotenone			•				•													x	x																
Sevin	•		•	•	•	•		•				•	•		•				x	x			x	x	x					x				x			
Supracide												•							x					x	x					x							
Thimet									•			•							x						x												
Thiodan	•		•		•	•	•	•			•	•		•	•	x	x	x	x	x	x	x		x	x				x								

NOTE: — Refer to specific crop section for insects controlled and to determine recommended product formulation and rates.
— Apply according to label directions.

• — Products registered for use on crop

X — Insects controlled at recommended rate(s).

A — Do not use on green bunching onions.

1 — Only ONE application permitted for export.

B — Apply only with Pro-Gro treated seed. Use only on dry and pickling onions.
Cutworm control with Lorsban 4C — Pre-Harvest wait of 60 days.
Onion Maggot control with Lorsban 15 G — Pre-Harvest wait period of: Dry onions — 141 days
Pickling Onions — 97 days

C — For use only on broccoli and cabbage.

GENERAL RECOMMENDATION:
Cutworms — Apply Lorsban at recommended rates.
Grasshoppers — Apply Malathion at recommended rates.
Refer to Page 9 for Pre-Harvest Wait Periods.

Table 3 — Fungicides Recommended for Disease Control in Vegetable Crops

FUNGICIDE	Asparagus	Beans (snap)	Beets Red	Cabbage, Cauliflower, Brussel Sprouts, Broccoli	Carrots	Celery	Corn (Sweet)	Cucumbers, Pumpkins, Squash	Eggplant	Lettuce	Onion	Peppers	Potatoes	Radish	Rutabagas	Tomatoes
Anilazine						7					1					
Benomyl		14			0			0								
Captafol													1		1	
Captan (seed treatment)		•	•	•			•	•			•	•	•	•	•	
Carbathiin & Thiram (seed treatment)											•					
Chlorothalonil		14		7	1	7		1				1			1	
Fenaminosulf (seed treatment)		•	•				•	•[b]								
Fixed Copper		1						1				1			1	
Mancozeb					7							1			1	
Maneb					5							1			1	
Metiram	•[a]				5							1			1	
Thiobendazole												•[c]				
Thiophanate methyl		14										•[d]				
Thiram (seed treatment)		•	•	•	•	•	•	•	•	•	•		•	•	•	
Zineb	•[a]				7										5	

DISEASES	Angular Leaf Spot (Cucumbers)	Anthracnose (Beans)	Bacterial Blight (Beans)	Blast and Purple Blotch (Onions)	Downy Mildew (Broccoli, Cauliflower)	Dry Rot (Potatoes)	Early & Late Blight & Leaf Spot (Celery, Potato, Tomato)	Gray Mold (Onions)	Powdery Mildew (Cucumbers)	Rust (Asparagus)	Scat (Cucumbers)	Seed Decay & Damping Off	Seed Piece Diseases Potato	Silver Scurf (Potato)	Smut (Onion)	White Mold (Beans and Carrots)
Anilazine			X			X										
Benomyl							X	X		X				X		
Captafol						X										
Captan (seed treatment)											X	X		X		
Carbathiin & Thiram (seed treatment)														X		
Chlorothalonil			X			X		X		X					X	
Fenaminosulf (seed treatment)																
Fixed Copper	X	X	X			X										
Mancozeb						X					X	X				
Maneb						X										
Metiram						X			X		X	X				
Thiobendazole					X							X	X			
Thiophanate methyl															X	
Thiram (seed treatment)											X			X		
Zineb						X			X							

• = Recommended on Crop
A = Numbers indicate recommendations on crops and days between last spray and harvest
[a] = Do not apply to asparagus spears that are to be cut
[b] = Cucumbers only
[c] = Post harvest potato seed piece treatment
[d] = Seed piece treatment

X = Indicates disease controlled

NOTE: — Numbers indicate days between last spray and harvest
— Refer to specific crop section for diseases controlled and to determine recommended product formulation and rates.
— Apply according to label directories.

Table 4 — Compatibility Chart of Spray Chemicals

	Basudin (diazinon)	Benlate Easout	Birlane	Botran	Bravo	Captan, Difolatan	Coppers (fixed)	Cygon, Rogor, Dimethoate	Dasanit	Dibrom, Phosdrin	Dipel, Thuricide	Di-Syston	Dithane M-22, M-45	Du-ter	Dyfonate	Ethion	Furadan	Guthion	Kelthane	Lannate	Malathion	Manzate-D, 200 Mantox	Metasystox-R	Methoxychlor	Monitor	Parathion	Pirimor	Polyram, Zineb, Dithane Z-78	Sevin	Systox	Thiodan			
Basudin (diazinon)	‖		O				D		O	O		O			O		O			O	O		O		O		O			O				
Benlate, Easout		‖	O				C																		O	C	O							
Birlane	O	O	‖	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		
Botran			O	‖		O	X	O	O	O		O	WP	O	O	WP	O	O	WP	C	WP	WP	WP	WP	O	WP	O	WP		WP				
Bravo			O		‖											O		O	C						O		O							
Captan, Difolatan			O	O		‖	O		O			O	O		O	WP	O		WP		WP	O	WP	WP	O	WP	O	O		WP	WP			
Coppers (fixed)	D	C	O	X		O	‖		O			O	D		O	O	O					D			O		O	D	X					
Cygon, Rogor, Dimethoate			O	O				‖	O								O			O					O		O							
Dasanit	O		O	O		O	O	O	‖	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O			
Dibrom, Phosdrin	O		O	O					O	‖						O				O		O		O		O			O				
Dipel, Thuricide			O	O					O		‖	O												O									
Di-Syston	O		O	O		O	O		O		O	‖	O	O		O		O	O	O	O	O	O	O	O		O	O	O	O			
Dithane M-22, M-45			O	WP		O	D		O			O	‖		O	O	O					O		WP	O		O	O						
Du-ter	WP		O	O				O				O		‖			O	O							O		O		WP		O			
Dyfonate	O		O	O		O	O		O				O		‖		O		O	O	O	O	O	O	O	O	O	O	O	O				
Ethion			O	WP		WP	O		O				O			‖	O		O		O	O	O	O	O	O	O	O	O	O				
Furadan	O		O	O		O	O	O	O	O		O	O		O	O	‖	O	O	O	O	O	O	O	O	O	O	O	O	O	O			
Guthion			O	O					O							O	‖								O		O							
Kelthane			O	WP	O	WP			O			O			O	O	O	‖							O		O							
Lannate	O		O	C	C			O	O			O			O		O		‖						O		O							
Malathion	O		O	WP		WP			O	O		O			O	O	O			‖					O		O							
Manzate-D, 200, Mantox			O	WP		O	D		O			O	O		O	O	O				‖		WP		O		O	O						
Metasystox-R	O		O	WP		WP			O	O		O			O	O	O					‖			O		O			O				
Methoxychlor			O	WP		WP			O			O	WP		O	O	O				WP		‖		O		O	WP						
Monitor	O	O	O	O	O	O	O	O	O	O		O	O		O	O	O	O	O	O	O	O	O	‖	O	O	O	O	O	O	O			
Parathion		C	O	WP		WP			O						O	O	O							O	‖	O								
Pirimor	O	O	O	O	O	O	O	O	O	O		O	O	O	O	O	O	O	O	O	O	O	O	O	O	‖	O		O	O				
Polyram, Zineb, Dithane Z-78			O	WP		O	D		O			O	O		O	O	O				O		WP	O		O	‖							
Sevin			O				X		O			O			O	O	O							O				‖						
Systox	O		O	WP		WP			O	O		O			O	O	O					O		O		O			‖					
Thiodan			O			WP			O						O									O		O				‖				

□ = Generally compatible.
X = Incompatable.
O = Not usually mixed or compatibility unknown.
WP = Use wettable powder forms.
D = Decomposes on standing, use immediately.
C = Generally satisfactory, but occasionally damage occurs.

This chart applies only to the use of two material combinations. When three or more materials are mixed or when a wettable powder and a liquid formulation are mixed, incompatibility may develop. *In call cases follow directories on the label.*

SPREADERS and STICKERS (SURFACTANTS) — Usually surfactants are incorporated into pesticide formulations by the manufacturer. Unless otherwise specified on the pesticide label, *do not* add surfactants.